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ABSTRACT

This publication is part of a series that reprints articles on a range of thematic issues published in the "Canadian Journal of Higher Education." This collection focuses on graduate education in Canada. After a preface and an introduction, the five articles are: "Graduate Student Supervision Policies and Procedures: A Case Study of Issues and Factors Affecting Graduate Study" (XXV:3, 1995) (Janet G. Donald, Alenoush Saroyan, and D. Brian Dennison); "Organization and Administration of Graduate Studies in Canadian Universities" (XXIV:1, 1994) (Edward A. Holdaway); "Supervision of Graduate Students" (XXV:3, 1995) (Edward A. Holdaway, Claude Dubois, and Ian Winchester); "Predictors of Time to Completion of Graduate Degrees" (XXIV:2, 1994) (Peter M. Sheridan and Sandra W. Pike); and "The Ph.D. Dilemma in Canada Revisited" (VIII:2, 1978) (Max von Zur-Muehlen). (Individual articles contain references.) (SM)

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CENTRE FOR HIGHER EDUCATION RESEARCH AND DEVELOPMENT

CANADIAN SOCIETY FOR THE STUDY OF HIGHER EDUCATION

CHERD/CSSHE READER SERIES

Number 2

GRADUATE EDUCATION IN CANADA

CHERD/CSSHE
Reader Series

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Edited by

Alexander D. Gregor
Centre for Higher Education Research and Development
University of Manitoba

Series Editor

Alexander D. Gregor
Centre for Higher Education Research and Development
The University of Manitoba
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COMMUNITY COLLEGES IN CANADA

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Preface

The *CHERD/CSSHE Readers Series* represents a collaborative partnership of the Centre for Higher Education Research and Development and the Canadian Society for the Study of Higher Education. The series is intended to bring together the best articles that have been published in the *Canadian Journal of Higher Education*, in a range of thematic issues. It is hoped that the collection will provide a useful basis for the systematic examination of those issues, on the part of both researchers and practitioners; and that they will stimulate further investigation in those critically important areas of scholarship and practice.

Alexander D. Gregor
General Editor

Introduction

Among the many anomalies surrounding higher education research, one that constantly surprises is the disjunction between the presumed "real world" importance of a topic, and the amount (or dearth) of systematic research that has actually been carried out on it. Something so fundamental to the nature and mission of the contemporary university as graduate studies is an example in point. The twenty-five year history of *The Canadian Journal of Higher Education* has seen only six articles published on the topic: barely enough to fill one issue.

Until the 1960's, graduate studies in Canada tended to be a rather underdeveloped and sleepy adjunct to the main endeavour of the university — its undergraduate teaching and professional education.[1] Indeed, the majority of Canadians going on to advanced study with a career in academe in mind tended to look to foreign institutions to complete their studies — and did so without any particular blame being attributed to themselves or to the domestic institutions. The frantic growth spurt of the Canadian university and the post-secondary system that began in the 1960's, however, drew dramatic political attention to the rather rudimentary state of the country's graduate enterprise. It was in part a matter of not being able to meet the huge increase in staffing demand that characterized the period — and of not being able to meet it by such a margin that, for years following, there remained the concern, both inside and outside the academy — that Canadians had in large measure lost control of their own universities. The slack quite naturally had to be met by a major importation of non-Canadian scholars, with a concomitant disruption of the traditional ecology of the country's academy. The concern lay in part at bitterness over hiring practices — with at least the perception of a bias toward networks of which Canadian applicants were just not part. More seriously, however, the argument was made that the character of research and professional training that accompanied this massive importation of scholarship was not meeting or reflecting the special needs and circumstances of this country. Even more exacerbating was the perception that any serious consideration of things Canadian was being derided as something parochial and second-rate by scholars who measured their work by the norms of the international academic community. These concerns were serious enough to prompt the Association of Universities and Colleges of Canada to strike a prominent national commission on Canadian Studies, under the chairmanship of Professor T.H.B. Symons. His seminal report, *To Know Ourselves,* confirmed the problem — and in so doing raised a storm of controversy that ultimately spilled into the domain of public policy and resulted in the federal government's introducing legislation governing the search procedures for academic appointments, giving in effect first preference to qualified Canadians.

At the same time as this quintessentially Canadian controversy raged, governments at both the federal and provincial levels were coming to the gradual realization that graduate studies was more than just an incidental adjunct to the university enterprise, but was rather something that was going to be increasingly critical to the economic and social health of the country. And notwithstanding Canada's odd reticence and ambivalence in the emerging realm of scientific and technological "R&D", business and industry were also beginning to see the development of graduate studies — and its *alter ego,* the research enterprise — as central to their own well-being. Here, a history that for a number of reasons had caused the country's research base to be almost exclusively centred in the university gave a special urgency to the health of the graduate enterprise.

With this new level of interest (and self-interest), universities and their public and private supporters began to grapple with the issues of structure and support: support for the graduate students themselves; and support for the research infrastructure (from libraries to laboratories) that would have to underpin the enterprise. Unfortunately, the "literature" associated with this mad scramble tends to be in the form of institutional and government documents that had relatively little currency in the public domain. (A particularly valuable example is to be found in the 1965 *Report of the President's Committee on the School of Graduate Studies, Graduate Studies in the University of Toronto,* a blue-ribbon committee under the chairmanship of Boris Laskin.) Given the very different traditions and circumstances of the universities across Canada, it is not surprising that the mechanics and structures emerged in quite different shapes and patterns — with distinct differences in the degree of centralization and decentralization was to characterize the enterprise, and in the relationships that would be established with kindred university offices (as, for example, research administration). These and related issues have been examined by Edward Holdaway in his article entitled *Organization and administration of graduate studies in Canadian universities.*

Organizational issues did not end with the individual institutions getting their respective houses in order, however. A range of internal and external forces subsequently propelled the institutions toward various forms of inter-institutional and inter-sectoral collaboration, to new relationships with the private and public sectors, and to provincial and regional coordination. Although these new thrusts have been the topic of a range of policy documents, research on their implications and consequences in the graduate enterprise have yet to reach the pages of *the Journal.*

An increasingly complex world has even forced nascent national planning in the realm of graduate education. The impact of communication technology, the advent of entrepreneurial foreign purveyors of graduate programs, and the need to respect language and distance needs have moved things beyond what the older structures could sustain. In response there has been, at the system level, a more proactive Canadian Association of Graduate Studies; and at the political level, an increasingly active Council of Ministers of Education, Canada. The effects of this new level of activity deserve careful attention.

At the national level as well, the federal government's indirect involvement in the domain of education — a constitutional jurisdiction jealously guarded by the individual provinces — found a natural affinity in the graduate enterprise. The federal government's responsibility for manpower planning and training, and for economic, technological and scientific development, gave it an immediate and legitimate vested interest in what was happening at the university level in graduate training and research. (In the "teaching" dimension, the federal government had been forced back a considerable distance, to provide general support trough transfer grants to the provinces. At the graduate level, federal policy could in fact play a direct role in shaping the academic enterprise.) In part this involvement was to come in the form of general strategies for graduate student support (in the form, for example, of doctoral fellowship programs); and of more specific strategies to accomplish certain social and planning goals — as, for example, programs to encourage women to consider graduate study in science and engineering. Other activities affected the graduate enterprise more indirectly; efforts to direct research monies to defined "strategic" and interdisciplinary areas carried with them concomitant effects on graduate student support and training. And although they were directed primarily at the graduate and research enterprise, those same efforts were to have significant secondary effects on the undergraduate enterprise and the character of the institution as a whole: affecting everything from who was hired to what was rewarded. Critics and commentators have noted how the contemporary university has been reshaped, for good and ill, from "above", as the research mandate became the defining principle. For Canadian universities, the *Maclean's* ranking phenomenon has offered telling evidence of that influence. Unfortunately, the influence that graduate studies has played in reshaping the contemporary university has not yet been the grist of *CJHE* articles.

Emerging from the new-found concerns over social and economic planning came a range of issues related to the numbers of prospective and current graduate students in the various areas of study, and concomitant efforts to match those numbers again forecasted needs in the academy itself, and in the public and private worlds that were now depending on the university's graduate programs for their "highly skilled workers". An example of that forecasting endeavour, and the heated debates as to whether the universities could or would need the anticipated national and regional needs, is to be found in an article by Max von Zur-Muehlen, entitled *The Ph.D. dilemma* in Canada revisited. As resources became tighter, this concern with monitoring the patterns of graduate enrolment took on an additional edge, with questions about the basic efficiency of the operation. From provincial commissions to the Canadian Manufacturers Association, the question was raised of whether the universities were moving graduate students through the system in an expeditious manner (or whether the very structure of the graduate programs presented inherent but unnecessary blocks to such expeditious passage). The flavour of this controversy can be sampled in a paper by Peter M. Sheridan and Sandra W. Pyke, entitled *Predictors of time to completion of graduate degrees.* Time to completion and patterns of are but two "performance indicators" that have become the focus for accountability in the postsecondary enterprise. In anticipation of an almost inevitable increase in public interest in the graduate enterprise, it will be important for researchers to stay one step ahead, in determining the appropriate criteria and measurement for performance at that level.

Apart from those questions of efficiency, only quite recently has attention expanded to include consideration of the actual process and content of graduate education. One central part of this issue of process has to do with the unique relationship enjoyed by student and supervisor, as the former is inducted by degrees into the culture and craft of the profession. Deans of Graduate Studies spend a good deal of their time attending to the various problems that emerge when that relationship goes wrong; and its success is just too important to the career and prospects of the student to allow it to built on assumptions and personal experience alone. Two articles have given focused attention to the relationship and to the question of what the institution can do to foster the right kinds of experience. Janet G. Donald *et al.* examine the matter in their paper entitled *Graduate student supervision policies and procedures: A case study of issues and factors affecting graduate study;* as do Edward A Holdaway *et al.* in *Supervision of graduate students.*

Commentators on Canadian higher education, from the National Forum of 1987, to the Smith Commission Report of 1991 have reiterated the growing need for research in higher education. It is obvious that those admonitions apply with particular poignancy to the critically important domain of graduate education.

Alexander D. Gregor

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Notes

[1] cf Robin S. Harris (1976). *A History of Higher Education in Canada 1663-1960.* Toronto: The University of Toronto Press.

Graduate student supervision policies and procedures: A case study of issues and factors affecting graduate study

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Abstract

This study was designed to identify salient issues in supervision across disciplines at a Canadian research university with a history of decentralized administration of graduate programs. Three sets of issues guided the inquiry: (a) the definition of supervision, (b) policies and procedures for supervision, and (c) the resources available for supervision. Although most departments reported having some form of policies and procedures, they did not tend to be explicitly stated or communicated. According to program directors, the two most important factors in the graduate supervision process were the supervisor's knowledge of the research field and his or her availability. There was considerable variability across faculties in the existence of policies and in the importance attached to different factors. Resources also varied greatly across disciplines. One conclusion of the study is that since the process of supervision is complex and occurs within a disciplinary context, much of the effort involved in enhancing the quality of graduate student supervision must be made at the department level. However, a comprehensive definition of graduate student supervision is needed to ensure that, where possible, there is common ground for graduate student supervision policy and practice.

This paper is based on research funded by the Social Science and Humanities Research Council of Canada and the Québec Fonds pour la Formation de Chercheurs et l'Aide à la Recherche.

Résumé

Cette étude a été conçue de manière à identifier des questions importantes de supervision dans diverses disciplines, dans une université de recherche canadienne ayant des antécédents en matière de décentralisation administrative de programmes d'études supérieures. Trois ensembles de questions ont guidé l'étude: (a) la définition du terme supervision, (b) les politiques et procédures régissant la supervision, et (c) les ressources affectées à la supervision. Si la plupart des départements ont dit disposer de quelconques politiques et procédures, plus rares étaient ceux qui les avaient formulées ou communiquées explicitement. La connaissance du domaine de recherche et la disponibilité du superviseur étaient les deux facteurs les plus importants du processus de supervision. On a constaté des différences considérables entre les facultés pour ce qui a trait à l'existence de politiques et à l'importance attachée à divers facteurs. Le niveau de ressources variait en outre grandement d'une discipline à une autre. L'étude conclut notamment que, le processus de supervision étant complexe et s'inscrivant dans le contexte d'une discipline, une grande partie des efforts déployés afin de relever la qualité de la supervision des étudiants aux niveaux supérieurs doit se faire dans les départements. Toutefois, il y aurait lieu de formuler une définition globale de ce qu'on entend par supervision des étudiants aux niveaux supérieurs afin de s'assurer que la politique et la pratique en matière de supervision des étudiants à ces niveaux reposent dans la mesure du possible sur une base commune.

Supervision plays a critical role in the introduction to and preparation of graduate students for scholarly life (Katz & Hartnett, 1976; Powles, 1988). In light of its potential impact on attracting, retaining, and graduating students, the supervision process has become an increasingly important topic, particularly at research universities. Reports have shown that constant, thoughtful supervision is a key to successful graduate program completion (Holdaway, 1991). Despite such assertions, since 1968, there has been an increase in the time to complete doctoral degrees which has in turn led to questioning both the output of graduate education and the definition of its content (Tuckman, 1991). Conceptual ambiguity characterizes the definition of graduate student supervision. Some disciplines may define it as a process of aiding the student to become a member of a research team and by extension, a member of the discipline. Others may conceive of supervision more narrowly as setting deadlines to ensure that students complete learning and research tasks.

One reason that institutions have made little progress in establishing cross-disciplinary consistency in supervision practice is that departments function as gatekeepers or guardians of the disciplines, particularly at entry to the level of acknowledged disciplinary expertise. They may therefore be unwilling to allow standards from outside the discipline to be imposed upon the education of potential members of their own discipline. Moreover, major disciplinary areas differ in the emphasis they place on the kind of assistance to be offered to students and on the relative importance of various aspects of supervision (Holdaway, Deblois, & Winchester, 1994). A more fundamental problem, however, is the limited understanding of graduate student development. Despite research on time to completion, there are few procedures in place to guide students through the developmental stages they undergo as they progress in their graduate programs.

University policy statements reflect limited comprehension of the supervision process. Accountability procedures in universities tend to conceptualize supervision in terms of general indicators or outcomes of graduate education, for example, the number of graduates completing their degrees within a specified time frame or the number of fellowships received by students. While supervision has some influence on these outcomes, they reveal little about either the process of supervision or the factors determining its effectiveness. At the same time, there is growing suspicion that graduate student supervision is an under-resourced area in the university. Without a sense of the constituent parts of the supervision process, however, it is difficult to put forward logical arguments for the kinds of resources needed for supervision. These issues — ambiguity in the definition of supervision, policies not specifically attuned to the supervision process, and limited resources — constrain the efficacy of universities in providing quality supervision and, therefore, assuring the development of the future professoriate.

If the quality of graduate student supervision is to be improved in our universities, we need to know more about policies and related practices and the factors that are considered important in graduate student supervision. The purpose of this study was to identify salient issues in graduate student supervision across disciplines by examining the state of current policies and procedures at a Canadian research university with a history of decentralized administration of graduate programs. Although policies for graduate student supervision existed in the university, little was known about which policies and procedures were recognized and adhered to by various faculties and departments and to what extent factors affecting graduate study were considered important. The first step in this process was to review the literature for available definitions of supervision.

Definition of graduate student supervision

Supervision is widely recognized as being complex and multidimensional. Often no distinction is made between research supervision, advising, and field supervision. In one attempt to define it, graduate student supervision was described as a blend of academic expertise and the skillful management of personal and professional relations (Ballard & Clanchy, 1993). The American Council of Graduate Schools in Research student and supervisor (1990) suggests that there are two major aspects to the supervision of graduate research students:

> The first and more important has to do with creativity and involves the ability to select problems, to stimulate and enthuse students, and to provide a steady stream of ideas. The second aspect is concerned with the mechanics of ensuring that the student makes good progress. (p. 5)

The Council of Graduate Schools (1990) takes the perspective that because the intellectual and interpersonal aspects of graduate studies are so dependent on the characteristics of the persons involved, it is extremely difficult to provide any general guidance. Consequently, its recommendations and guidelines focus on the mechanics or procedures of supervision, as do the recommendations of the Commission of Inquiry on Canadian University Education (Smith, 1991). For example, the Commission specified required reporting on the status of each graduate student and on the schedule for completion of studies.

Recent attempts to conceptualize graduate student supervision have tended to emphasize the interpersonal or socialization roles of supervisors as well as being an advocate and role model both within the department and the profession (Winston & Polkosnik, 1984). These attempts reflect the understanding that although expertise in one's field of specialization and active involvement in research are prerequisites for a supervisor, they do not guarantee good supervisory practice (Powles, 1993). Students expect their supervisors to have knowledge and the ability to supervise in a particular area of research but also want them to be reasonable, serious, supportive of their work in good times and bad, and approachable (Moses, 1985). Moreover, supervisors are expected to take the lead in establishing relations with their students so that their knowledge and skills are readily accessible to students (Ballard & Clanchy, 1993). One author has asserted that personal support is the most important dimension of supervision (Salmon, 1992). These interpersonal qualities, neither easily prescribed nor proceduralized, seem to be gaining importance in the supervision literature.

Conceptualization of the roles and functions of graduate supervision becomes more complex in light of the stages of development graduate students go through during graduate studies (Bargar & Mayo-Chamberlain, 1983; Beeler, 1991; Tinto, 1993; Winston & Polkosnik, 1984). Research suggests that most doctoral students progress through four stages: program entry, program building, general or comprehensive examinations, and dissertation (Bargar & Mayo-Chamberlain, 1983). The dissertation stage consists of four substages of developing the topic, doing the research, writing the thesis, and defending it. A fifth stage, separation and job placement, has been identified by Winston and Polkosnik (1984). At each stage, graduate students are likely to need different forms of guidance. During the initial weeks, for example, entering students (particularly at the master's level) are likely to require a high degree of structure and direction from their supervisors (Winston & Polkosnik, 1984). Students also need particular guidance on when to stop data collection and analysis, when to start drafting the thesis, and how to structure it (Moses, 1992).

The various needs of students on the one hand, and the diverse academic responsibilities of professors on the other, make the characterization of good supervision even more elusive. The task is further complicated by the varied range of resources that departments and universities provide in support of supervision. For example, some departments accept only those students whom they can support financially through research or teaching assistantships. Many graduate programs list courses on research methods or thesis preparation; these could be expected to provide considerable guidance to students in the development of their dissertations. Departmental organization that structures the environment of the student in this manner allows supervisors to attend to more specific issues of supervision.

Supervision Policies

Even though the supervision process may not be well understood, both general and specific policies relating to graduate student supervision are found in university documents. Generally speaking, foremost among institutional concerns is ensuring that students graduate within a reasonable period of time (Bowen & Rudenstine, 1992; Moses, 1992; Powles, 1988; Sheridan & Pyke, 1994). University-wide policies are, however, often constrained since decision-making authority tends to rest in the departments or faculties which claim varied disciplinary needs and cultures.

In the university examined in this case study, documented policies for procedures to be followed were found in reports produced by the Graduate Faculty Council (1986) and in the Students' Handbook on Rights and Responsibilities. The Graduate Faculty Council (1986) document, Time to Complete Graduate Studies, made specific suggestions about departments' responsibilities concerning student progress, including ensuring regular meetings and an annual assessment of student progress, copied to the student. In this document, it was stated that graduate studies require full-time status. In addition to these policies, a Senate-approved report on university-wide priorities (1991) provided extensive recommendations about standards, procedures for graduate studies, and supervision quality and efficacy. Graduate student supervision was to include guidance in the choice of courses and seminars, encouragement to publish and to participate in national and international conferences, and the provision of a fund to support graduate students in these activities. Specific procedures were recommended to establish clear schedules and formal supervisory committees. However, since many of the responsibilities and procedures for supervision issues were department-based, the extent to which university policies were deemed appropriate or were consistent with practice in departments was not known.

Resource Base for Supervision

A further stumbling block in ensuring adequate supervision is the provision of resources and procedures within a given department. While professors are increasingly recognized by university awards for exceptional supervision (for example, in Graduate Faculty teaching awards), departments have placed little emphasis on the value of supervision for workload credit. A related mediating variable for the quality of graduate supervision which has received little attention is the number of students supervised by a supervisor. Formally established limits on the number of graduate students who can be supervised by an individual professor are rare in graduate programs at Canadian universities: only 9.4% of programs surveyed in Canada have established such limits (Holdaway, Deblois & Winchester, 1993). Among these, 78% have established a maximum student-to-supervisor ratio of less than or equal to 6:1. An optimum student/staff ratio would be that which facilitates supervision and reasonable time to completion. Optimum student/staff supervision ratios, however, are difficult to set as they will vary according to the professor's academic responsibilities, including the number and level of courses taught, the number of other professorial duties of a research or administrative nature, the organization of the professor's research program, and the level of research of students (master's or doctoral).

Another important resource factor in students' experience of graduate education is gender representativeness (Berg & Ferber, 1983; Epp, 1994; Hite, 1985). Of immediate relevance to supervision is the existence of gender role models which may be particularly beneficial for female graduate students (National Advisory Board on Science and Technology, 1993). For example, a positive relationship has been found between the number of female faculty and the number of female students successfully completing doctorates in the natural sciences (Tidball, 1986). In another study, female graduate students recommended that universities employ more female professors to provide more role models (Epp, 1994). These findings suggest that the number of same gender supervising faculty available for students is another potential benchmark for program quality.

Objectives of the Study

Given the preceding research base, this study was designed to address four objectives concerning the quality of supervision at a Canadian research university with a history of decentralized administration of graduate programs. The first was to establish the resource base for supervision across disciplines, principally the availability of faculty. The second was to determine which departments had explicit policies and procedures, the nature of the supervision issues addressed by them, and the means by which they were communicated to department members. The third objective was to establish the extent to which various factors, both interpersonal and procedural, were perceived by those responsible for the programs — graduate program directors — as important in graduate student supervision. The fourth objective was to determine the means by which graduate supervision was evaluated in various faculties and departments.

Method

In 1992, a survey questionnaire was designed in conjunction with the Faculty of Graduate Studies and was sent to all graduate program directors in the faculties offering graduate degrees in the university. The questionnaire consisted of sets of questions on (a) the existence of supervision policies and procedures in the department and how these were communicated, (b) whether there were specified procedures for the assignment of students, financial assistance, etc., and (c) the importance of various factors, for example, knowledge of the research field or of policies and procedures. A 6-point scale was used to rate the factors. (The scale consisted of the following ratings: 0 = no importance, 1 = very low importance, 2 = low importance, 3 = moderate importance, 4 = high importance, 5 = very high importance.) Recipients were asked to complete the survey on behalf of their departments or programs, to include a statement of the number of graduate students and faculty who supervise students in the department or program, and to supply documents concerning the policies and procedures for graduate student supervision used in their departments. Comments were invited on the topics addressed in the survey.

In this university, six faculties consist of departments (Agricultural Science, Arts, Education, Engineering, Health Science and Science). From these faculties, 48 program directors returned questionnaires, accounting for 69% of the approved master's level graduate programs and 70% of the approved doctoral programs. The response rates for master's programs ranged from 61% to 88%, while that for doctoral programs ranged from 60% to 100%.

To obtain the student/staff ratio, the number of graduate students enrolled as reported by each department was divided by the number of supervisors reported as available. The figure of 6:1 was adopted as a benchmark for purposes of comparison (Holdaway, Deblois & Winchester, 1993). In addition to frequency data, comments from the program directors' questionnaire forms were used to elucidate findings.

Results and Discussion

Resource Base

The student/supervisor ratios for five of the six faculties fell at or below the benchmark figure of 6:1; only Education had a higher ratio (12:1) (Table 1). Almost two-thirds (64%) of the graduate students were enrolled at the master's level but proportions fluctuated across the faculties, with Education (87%) the highest, Engineering (67%) and Agricultural Sciences (62%) average, and Health Sciences (49%), Arts (48%) and Science (45%) the lowest. One explanation for the variability in the proportion of master's level students is the additional responsibility that some faculties have for professional upgrading. For instance, in the faculty of Education, courses taken for professional upgrading are at the graduate level and lead to a master's degree in education. While the university has adopted a new policy which places greater emphasis on doctoral rather than on master's level degree programs, apparently in at least one faculty this emphasis is moderated by the faculty's decision to remain responsive to the needs of its local professional community. Would this affect the student/supervisor ratio in the need for more or less supervision? Universities have argued that doctoral degrees require more time to complete and hence doctoral supervision should receive more credit. However, from a developmental perspective, one could argue that master's level students, being novices in graduate education, would require more intensive supervision.

Approximately equal numbers of men and women were enrolled in graduate level programs overall (52% male and 48% female) (Table 2). Within the master's level programs, there were more women (56%) than men (44%). At the doctoral level, however, the percentage of women was 35%, closely matching the reported percentages of female doctoral

Table 1

Number and Ratio of Graduate Students and Supervisors in Programs as Reported in Survey

	Students				
Faculty	Master's	PhD	Total	Supervisors	Student-to-Staff Ratio
Agricultural Science	164	99	263	66	4:1
Arts	162	173	335	77	4:1
Education	693	108	801	65	12:1
Engineering	468	231	699	125	6:1
Health Science	262	276	538	267	2:1
Science	163	201	364	144	3:1
Total	**1,912**	**1,088**	**3,000**	**744**	**4:1**

Table 2

Number and Percentage of Graduate Students by Gender

	Master's		PhD		Total	
Faculty	Male	Female	Male	Female	Male	Female
Agricultural Science	94	70	70	29	164	99
	57%	*43%*	*71%*	*29%*	*62%*	*38%*
Arts	61	101	82	91	143	192
	38%	*62%*	*47%*	*53%*	*43%*	*57%*
Education	103	590	37	71	140	661
	15%	*85%*	*34%*	*66%*	*17%*	*83%*
Engineering	358	110	211	20	569	130
	76%	*24%*	*91%*	*9%*	*81%*	*19%*
Health Science	119	143	151	125	270	268
	45%	*55%*	*55%*	*45%*	*50%*	*50%*
Science	103	60	159	42	262	102
	63%	*37%*	*79%*	*21%*	*72%*	*28%*
Total	**838**	**1,074**	**710**	**378**	**1,548**	**1,452**
	44%	***56%***	***65%***	***35%***	***52%***	***48%***

students for Quebec and for Canada (Statistics Canada Data for 1991-92, CAUT Bulletin, 1993). Across faculties, there was wide variation in the ratio of men to women, particularly at the doctoral level. Engineering (81%) and Science (72%) reported the highest percentage of men, while Education (83%) reported the highest percentage of women.

In contrast, of the total number of supervisors in graduate programs, 21% were women and 79% were men (Table 3). This parallels the cross-Canada finding of 19% female and 81% male supervisors (Holdaway *et al.*, 1993). In the present study, while the university ratio of male students to male supervisors was 3:1, the ratio of female students to female supervisors was 9:1. For female graduate students, the availability of potential female supervisors was greatest in health science (3:1) and least in education (32:1), suggesting relatively limited candidate pools for same sex role models in some faculties.

Table 3

Number and Ratio of Graduate Students and Supervisors by Gender.

	Students*		Supervisors		Student to Supervisor Ratio	
Faculty	Male	Female	Male	Female	Male	Female
Agricultural Science	164 *62%*	99 *38%*	58 *88%*	8 *12%*	3:1	12:1
Arts	143 *43%*	192 *57%*	53 *69%*	24 *31%*	3:1	8:1
Education	140 *17%*	661 *83%*	44 *68%*	21 *32%*	3:1	32:1
Engineering	569 *81%*	130 *19%*	116 *93%*	9 *7%*	5:1	14:1
Health Science	270 *50%*	268 *50%*	187 *70%*	80 *30%*	1:1	3:1
Science	262 *72%*	102 *28%*	132 *92%*	12 *8%*	2:1	9:1
Total	**1,548** ***52%***	**1,452** ***48%***	**590** ***79%***	**154** ***21%***	**3:1**	**9:1**

* Master's and PhD students combined

Acknowledgment of Supervision

The specific acknowledgment and rewarding of time devoted by faculty to supervision in workload assignments (e.g., by reduction in number of courses) was reported by very few (7 or 15%) program directors. When asked to describe how good supervision was recognized, respondents made the following comments:

> *Good supervision is noted in departmental annual report and merit recommendations.*
>
> *Workload; Merit presentations.*
>
> *Not formally. Indirectly, students seem to acknowledge performance by making their choice of supervisor. Internship supervisors are evaluated by students but superior performance would depend on many factors not under control of supervisor.*
>
> *It represents part of the teaching dossier for supervisors for promotion and tenure considerations.*
>
> *As seen in final product of student's thesis/work.*
>
> *By means of intradepartmental scholarship.*

These results and comments suggest that current practice is to recognize supervision duties only within the more general framework of evaluation for merit or promotion. Thus, it can be deduced that supervision is not a specifically recognized responsibility measured in workload accounting within most departments.

Department Policies and Procedures

Most departments or faculties did not have an explicit definition of supervision. Only 36% of the program directors reported that they distinguished between different forms of supervision such as academic advising, research supervision, and field supervision. In most of those cases, academic advising was seen as separate from supervision and was often, but not always, carried out by individuals other than those supervising a graduate student's research. Responsibility for research supervision could be vested in a supervisor, a committee, or a supervisor and a committee. While most departments (83%) within the six faculties reported having some form of policies and procedures for graduate student supervision, the extent to which these were in written form varied a great deal from one faculty to another. For example, policies were explicitly stated in as many as 67% of the departments in Education and Health Sciences and in as few as 10% in the Faculty of Arts (Table 4).

Overall, the majority of departments (from 40% to 83% across faculties) claimed that existing policies and procedures were communicated to all supervisors of graduate students and were discussed in department meetings (50% to 100%). Supervisors relied on colleagues to find out about policies and procedures in relatively few departments (10% to 29%). As would be expected, it was relatively uncommon for departments to use the same policies or procedures for all programs or levels of graduate study. The Faculty of

Table 4

Percentage Indicating Existence of Supervision Policies and Procedures in Departments

Supervision Policy Characteristic	Agr (7)*	Arts (10)	Edu (6)	Eng (8)	Health (12)	Science (5)
There are policies and procedures in the department concerning graduate student supervision	100%	70%	83%	75%	83%	100%
Supervision policies and procedures are explicitly stated	57%	10%	67%	50%	67%	60%
All programs/levels (MA, PhD) use the same policies or procedures	29%	20%	33%	13%	38%	80%
Supervision policies and procedures are communicated to all supervisors of graduate students	71%	40%	83%	63%	75%	60%
Policies and procedures are compiled in a written document & are available to everyone in department/faculty	43%	30%	50%	38%	67%	40%
Supervision policies and procedures are discussed in department meetings	71%	50%	83%	50%	50%	100%
The Chair/Dean informs supervisors of existing department/faculty policies and procedures	57%	50%	50%	25%	25%	20%
Supervisors rely on colleagues to find out about policies and procedures	29%	10%	17%	13%	13%	20%

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* Number of questionnaires returned

Science, which also had the highest ratio of doctoral to master's students (55/45), was an exception in that 80% of its departments used the same policies for both master's and doctoral level students. This raises the issue of consistency of policy across both programs and levels.

In order to gain insight into how extensive the policies were, respondents were asked to indicate whether or not specific policies existed for a variety of supervision issues including the assignment of students to supervisors or to research assistantships, and the provision of financial assistance. One respondent's comment describes the limitations of such policies:

> *These terms would be, for us, more accurately described ... as "provisions," i.e.,. . . "provisions" for financial assistance, etc. These are conventions and mechanisms set by precedent, and there is no written delineation to my knowledge. There are no statutory provisions, but everything is possible.*

In summary, there was major variation within faculties in the extent to which policies were explicit or were communicated to supervisors. This would suggest that typically, supervisors have little to guide them in their relationships with their graduate students. Only in the Faculty of Science did all respondents state that supervision policies and procedures were discussed in their departments. Although graduate education is acknowledged to be an important function in each of the six faculties under study, one must question the level of administrative organization brought to bear. In three of the faculties, according to the directors of the graduate programs, discussion of issues pertaining to graduate supervision policies and procedures took place in only half of their respective departments.

The aspect of supervision for which policies and procedures were most likely to exist was the process of assigning students to supervisors (Table 5). All programs responding from the Faculty of Agricultural Sciences reported policies and procedures for student assignment, as did seven of eight Engineering programs. Policies for assigning workplaces to students and for setting up thesis committees also existed in the majority of departments. However, programs in Arts were less likely to have policies for assigning workplaces.

There was wide variation in the extent to which departments had policies and procedures for the assignment of graduate students to either research or teaching assistantships but policies were more likely to exist for the latter. The greater prevalence of policies pertaining to teaching assistantships might reflect differences in funding sources: operating funds support teaching assistantships while research grants support research assistantships. The training of graduate students to assume teaching responsibilities has increased in importance in universities in the last decade and the relationship of this training to graduate student research and supervision has become part of the debate about the definition of scholarship in higher education (see Diamond & Adam, 1993). Whether these are complementary or reciprocal activities remains to be established, but in terms of student development, they are both concerned with the socialization of graduate students into the discipline. Assistantships may be viewed as forms of financial support, however, rather than

Table 5

Percentage Indicating Existence of Policies and Procedures for Specific Supervision Issues Within Departments

Supervision Policy Issue	Agr (7)*	Arts (10)	Edu (6)	Eng (8)	Health (12)	Science (5)
Assignment of student to supervisor	100%	60%	83%	88%	83%	80%
Assignment of workplace to student	57%	40%	67%	100%	58%	100%
Assignment of thesis committee	43%	60%	67%	63%	67%	80%
Assignment of graduate students to research assistantship positions	14%	40%	17%	63%	25%	80%
Assignment of graduate students to teaching assistantship positions	29%	80%	67%	75%	38%	100%
Collaboration between student and supervisor on papers	29%	20%	33%	13%	38%	40%
Financial assistance for collecting thesis related data	14%	0%	0%	0%	26%	100%
Financial assistance for paper presentations at professional conferences	14%	40%	33%	25%	26%	60%
Inclusion of graduate students in policy decisions concerning supervision	29%	20%	50%	25%	50%	100%

* Number of questionnaires returned

as intentional educational components of the graduate curriculum. In this study, financial support for research assistantships and for professional development activities such as conference presentations was provided by half as many departments as provided funding for teaching assistantships.

The issues for which policies and procedures were least likely to exist were collaboration between student and supervisor on papers and financial assistance for collecting thesis data. Overall, departments in the Faculty of Science were most likely to have policies and procedures for dealing with specific supervision issues. While the differences across faculties may accurately reflect priorities and perhaps research funding in the faculties, they suggest a lack of coherence in the university.

Perceived Importance of Factors affecting Graduate Supervision

Program directors noted some difficulty in rating the importance of various factors affecting graduate supervision. Some stated that the relative importance of the factors would vary depending on the stakeholder group whose perspective was being assessed. Others noted that trying to differentiate among elements of graduate supervision was not easy as all the factors were very important. Some suggested that graduate supervision was usually unstructured.

The most important factors overall were knowledge of the research field and availability of the supervisor (mean ratings of 4.4 and 4.3 respectively, Table 6). These ratings closely match the research literature (Moses, 1985; Powles, 1993). While there was considerable variation among faculties in the perceived importance of many of the factors, a number of conclusions can be drawn from the overall results. First, individual supervisors play a much more important role in graduate student supervision than committees. Second, in three of the four science-based faculties (Agricultural Science, Engineering, and Science), knowledge of the research field was seen as the paramount requirement of a supervisor; in contrast, among non-science-based faculties, responsiveness to students (availability, promptness in providing feedback, sensitivity) was rated as more important. Third, in spite of increasing concern in universities over the time taken to graduate, this is not viewed as an overriding factor in supervision: mean ratings of importance across faculties ranged from 3.5 to 4.0 with an overall mean of 3.8. Finally, in spite of the high importance accorded the supervisor's knowledge of the research field by all faculties, coherence of thesis research with the supervisor's research tended to be of moderate importance: only Science departments had a mean above 4.0 (4.2).

Evaluation of the Supervision Process

Relatively few departments (14 or 29%) reported that they had a mechanism in place for evaluating the process of graduate student supervision. Respondents from the departments which evaluate supervision were asked to describe the criteria used in conducting such evaluations. Their responses dealt with both criteria and procedures and included the following:

> *No formal criteria.*
>
> *Student/prof ratio; areas of research; availability of faculty resources.*
>
> *Productivity; student complaints.*
>
> *Amount of time students take to complete the program (i.e., efficiency); quality of theses submitted; comments of external examiners.*
>
> *Reliability; timely completion of theses; availability.*
>
> *Time to complete theses; promptness to follow progress report guidelines.*
>
> *Number of students, their satisfaction, papers published, awards obtained.*
>
> *Carried out informally with students and in discussion with faculty colleagues.*

Table 6

Importance[1] of Various Factors in Graduate Supervision

Factor	Overall Average	Faculty Averages					
		Agr (7)*	Arts (10)	Edu (6)	Eng (8)	Health (12)	Science (5)
Knowledge of the research field	4.4	4.3	4.3	4.4	4.6	4.1	5.0
Availability of supervisor	4.3	4.2	4.4	4.6	4.0	4.3	4.4
Promptness in providing feedback to student on thesis related work	4.1	4.0	4.0	4.3	4.3	4.2	4.0
Sensitivity to student problems	4.0	3.5	4.0	4.2	3.6	4.2	4.2
Academic advising	3.8	3.5	3.9	4.2	3.9	3.9	3.6
Completion of graduate studies within stated period	3.8	3.5	4.0	3.6	3.9	3.6	4.0
Frequency of meetings with students	3.7	3.5	3.5	4.0	3.3	4.0	4.2
Time period within which research proposal is submitted	3.7	3.8	3.2	3.0	3.7	4.2	3.6
Knowledge of policies and procedures (e.g., course requirements and registration procedures)	3.5	3.2	4.0	4.0	2.4	3.8	3.4
Coherence of thesis research topic with supervisor's research	3.4	3.7	2.5	3.3	3.4	3.8	4.2
Time period within which formal supervisory committee is formed	3.3	3.7	3.8	2.0	2.7	3.8	2.6
Assistance in preparing fellowship proposals	3.1	2.7	3.4	3.3	2.3	3.7	3.0
Assistance in preparing research grant proposals	3.0	2.3	3.1	4.0	2.7	3.3	3.0
Frequency with which supervisory committee meets	2.9	3.0	2.7	2.3	2.3	3.6	2.6

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[1] The scale consisted of the following ratings: 0 = no importance, 1 = very low importance, 2 = low importance, 3 = moderate importance, 4 = high importance, 5 = very high importance.

* Number of questionnaires returned

> *Research performance; oral presentation of data; performance in courses.*
>
> *At time of tenure review, effectiveness of grad student supervision is one criterion —judged by output, success in completion, etc.*
>
> *Biennial reports signed by committee and student, submitted to Graduate Affairs Committee.*

The comments suggest that evaluation of supervision is global, using criteria which are based on cumulative outcomes (e.g., number of students graduated, number of papers published or awards received by students, or quality of theses submitted). Considering the importance accorded factors such as the availability of supervisors, sensitivity to student problems, and academic advising, as well as the importance of student ratings of teaching at the undergraduate level, little emphasis is placed on feedback from students on the process of supervision. Where student input is mentioned, it takes the form of student complaints or informal conversations, although the last comment refers to biennial reports as recommended in university policy statements.

Twenty program directors (42%) reported that supervisors are required to prepare an annual written assessment of student progress. The practice was most common in programs in the Health Science and Science faculties. Providing a copy of the annual assessment to the student concerned was slightly less common (35% of departments) and also occurred most frequently within departments of the same two faculties. With the exception of those faculties, practice is at odds with stated policy recommendations concerning the assessment of students.

Discussion

If the major purpose of graduate student supervision at both master's and doctoral levels, regardless of academic discipline, is to facilitate student progress to degree completion in a timely and educationally sound fashion, it is best characterized by the diversity of forms it takes across programs. The results of this study suggest that although university-wide policies and guidelines are in place, departments and faculties have interpreted them in different and sometimes limited ways.

The number of supervisors appeared to be adequate in five of six faculties in relation to the number of students. The limited number of female supervisors in some disciplines means that female graduate students have relatively limited opportunity to work with female supervisors and thus encounter fewer role models than their male peers. More problematic, however, is the fact that supervision is not specifically acknowledged in workload assignments, nor is it evaluated systematically. This is tantamount to according supervision a lower priority than other responsibilities in the department, when it may be one of the most important in terms of the development of the field and the training of future specialists.

There is very little formal organization within the university to aid graduate student supervisors in carrying out their responsibilities. One example of this state of disorganization is the ambiguity in the definition of graduate student supervision and hence, in the delineation of corresponding responsibilities. The literature provides a number of components of supervision which can be grouped under three headings: knowledge of policies and procedures, availability, and advising skills (Pascarella & Terenzini, 1980; Powles, 1988; Seldin 1980, 1984; Tromblay, 1984; Worthington & Roehlke, 1979). Knowledge of policies and procedures includes knowledge of: curricular requirements and course offerings, course requirements and registration procedures, institutional policies, research grants, and requirements for graduation. Availability supposes that supervisors have dedicated specific time for student contact. According to the literature, advising skills include the ability to be explicit about the expectations of students and to clarify students' expectations, to advise on career choices, to offer alternative suggestions related to course selection and thesis work while leaving the final judgment to the student, and to offer students constructive feedback on performance. Advising may also include offering helpful counsel in solving academic problems and non-academic problems such as health, language, or financial difficulties, and balancing study and employment. These skills go far beyond the formal expectations of supervision as stated in university policy.

The results of this study indicate that there is great variation in the extent to which departments have adopted policies and procedures for graduate student supervision, the manner in which and extent to which policies and procedures are communicated to supervisors and graduate students, and the importance accorded a variety of factors (e.g., supervisor's knowledge of research field, time to degree completion, sensitivity to student problems) which contribute to this process. The diversity in the practice of graduate student supervision between disciplines is to some extent explained by having decentralized faculties. Disciplinary differences also lead to diversity in supervision practice: disciplines offer varying degrees of structure in programs since they define the advancement of knowledge in different ways and hence have different views about what the learning task for their students should be. Diversity in supervision practice may be a result of the absence of comprehensive and commonly accepted conceptualizations of graduate student supervision and how supervision relates to the broader domain of graduate education.

In order to set policies and procedures for graduate student supervision, universities need to find ways by which they can ensure that graduate student supervision is consistently being carried out according to high standards across programs, while ensuring that faculties and departments have the flexibility to modify the form that supervision takes in order to accommodate the educational requirements of particular disciplines. Thus, much of the effort involved in enhancing the quality of graduate student supervision must be made at the faculty and department level. It follows that if the quality of supervision in individual departments is to be enhanced, those most directly affected — supervisors and their graduate students — should know the policies for graduate student supervision. It then becomes incumbent upon faculties and departments to determine their current policies, procedures and practices for graduate student supervision, and to ensure that they facilitate graduate education and are communicated to both supervisors and graduate students. Of major importance is establishing the priority given to supervision in the department and how it is rewarded, so that there is common understanding and appreciation of its role. Departments might also consider what types of professional and academic skills and attitudes faculty as a whole and supervisors in particular should model for their graduate students, and what activities department members might engage in with graduate students as a means of furthering professional socialization.

In human service organizations, the impetus for providing assistance results from delineation of responsibilities. Supervision responsibilities can be specified at four levels in a university: faculties of graduate studies, departments, supervisors, and students. The department, representing the discipline, has the major responsibility, including publishing information about the department and the research interests and publications of faculty, providing information about what is expected of graduate students, providing information about facilities and financial assistance available in the department, offering pre-enrollment advising, providing guidelines for regular meetings between student and supervisor, and informing supervisors of curriculum and policy changes in the university, faculty, and department. Department planning activities should ensure that in the areas of specialization offered by the department, more than one faculty member is available, that high standards of research are maintained, that a limit to the ratio of students to supervisor is set, and that procedures are in place for accountability regarding supervision and implementing change if results are not satisfactory. It should also be the department's responsibility to ensure that students are made aware of the expected timelines, and to provide workplaces for students and opportunities for contact between students and faculty. Acknowledging and rewarding time devoted by faculty to supervision as well as membership in doctoral committees is fundamental to ensuring quality supervision.

The responsibilities of the supervisor would include being knowledgeable about relevant policies, particularly issues such as comprehensive examinations, doctoral committee formation, committee meetings and the oral defense, if there is one. Supervisors could be expected to provide graduate students with research assistantships when possible, to provide guidance in the phases of the development of the thesis, to meet regularly with the student (for example, once a week for one hour), to provide prompt feedback when work is handed in (within one week), and to provide feedback about the research area, quality of work, and value of the research. Areas of joint responsibility between supervisors and departments might include clarifying expectations regarding collaborative work, authorship, publication, and conference presentations, maintaining a dossier on student progress (up-dated at least every semester), knowing graduation deadlines, and introducing the student to professional organizations and encouraging participation thereafter (for example, providing funding for initial participation at a professional meeting).

The responsibilities of students would include understanding the scope of master's and doctoral work such as the number of years to be devoted to full-time study, knowledge of research methods necessary to carry out studies, and the expectations of the supervisor regarding every aspect of the research (e.g., scope of the research program, role of the student as a research team member, team publications/ presentations, financial support versus sharing of ideas). Students should expect to work within deadlines, to communicate directly with the supervisor (particularly if misunderstandings arise), and to submit a comprehensive annual progress report to the supervisor and the department.

At a more general level, faculties of graduate studies should be developing a comprehensive description of graduate student supervision. Such a description would contribute significantly to ensuring that a common terminology exists for subsequent discussions of graduate student supervision. Among the issues which appear to need further examination are the similarities and differences in the types of graduate student supervision required in different academic disciplines and in the supervision of master's and doctoral students.

Evidently the process of supervision is complex. Given its importance in the development of knowledge and more specifically of fields of study, it is also critical that universities establish policies and procedures at several levels of the institution to enable professors and students to actively support that development.

References

Ballard. B., & Clanchy, J. (1993). Supervising students from overseas. In D. J. Cullen (Ed.), *Quality in PhD education* (pp. 61-73). Canberra: Australian National University.

Bargar, R.R., & Mayo-Chamberlain, J. (1983). Advisor and advisee issues in doctoral education. *Journal of Higher Education, 54*(4), 407-432.

Beeler, K.D. (1991). Graduate student adjustment to academic life: A four-stage framework. *NASPA Journal, 28*(4), 163-171.

Berg, H.M., & Ferber, M.A. (1983). Men and women graduate students: Who succeeds and why? *Journal of Higher Education, 54*(6), 629-648.

Bowen, W.G., & Rudenstine, N.L. (1992). *In pursuit of the PhD.* Princeton, NJ: Princeton University.

Council of Graduate Schools. (1990). *Research student and supervisor.* Washington, DC: Author.

Diamond, R.M., & Adam, B.E. (1993). Recognizing faculty work: Reward systems for the Year 2000. *New Directions for Higher Education, (81).* San Francisco: Jossey-Bass.

Epp, J.R. (1994). Women's perceptions of graduate level educational administration programs. *Canadian Journal of Higher Education, 24*(2), 43-67.

Friedman, N. (1987). *Mentors and supervisors.* New York: Institute of International Education. (ERIC Document Reproduction Service, ED 295 541).

Graduate Faculty Council. (1986). *Time to Complete Graduate Studies.* Montreal: McGill University.

Hite, L.M. (1985). Female doctoral students: Their perceptions and concerns. *Journal of College Student Personnel, 26*(1), 18-22.

Holdaway, E.A. (1991, June). *Organization and administration of graduate studies in Canadian universities.* Paper presented at the annual conference of the Canadian Society for the Study of Higher Education, Kingston.

Holdaway, E.A., Winchester, I.S., & Deblois, C. (1993, June). *Organizational issues in graduate studies.* Paper presented at the annual conference of the Canadian Society for the Study of Higher Education, Ottawa.

Holdaway, E.A., Winchester, I.S., & Deblois, C. (1994, June). *Opinions of supervisors of graduate students about supervisory practice.* Paper presented at the annual conference of the Canadian Society for the Study of Higher Education, Calgary.

Katz, J., & Hartnett, R.T. (Eds.) (1976). *Scholars in the making: The development of graduate and professional students.* Cambridge, MA: Ballinger.

McGill University. (1990). *Graduate Admissions.* Montreal: Author.

McGill University. (May, 1991). *Report of the Task Force on Priorities.* Montreal: Author.

McGill University. (1993). *A Handbook on Students' Rights and Responsibilities.* Montreal: Author.

Moses, I. (1985). *Supervising postgraduates.* Sydney, Australia: Higher Education Research and Development Society of Australasia, University of New South Wales.

Moses, I. (1992). Good supervisory practice. In I. Moses (Ed.), *Research training and supervision* (pp. 11-15). Canberra: Australian Research Council.

National Advisory Board on Science and Technology (1993). *Winning with women in trades, technology, science, and engineering.* Ottawa: Author.

Pascarella, E., & Terenzini, P. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. *Journal of Higher Education, 51,* 60-75.

Powles, M. (1988). *Know your PhD students and how to help them. Melbourne,* Australia: Centre for the Study of Higher Education, University of Melbourne.

Powles, M. (1993). Staff development for PhD supervision. In D. J. Cullen (Ed.), *Quality in PhD education* (pp. 75-84). Canberra: Australian National University.

Salmon, P. (1992). *Achieving a PhD –Ten students' experience.* Stoke-on-Trent, England: Trentham Books.

Seldin, P. (1980). *Successful faculty evaluation programs.* Crugers, NY: Coventry.

Seldin, P. (April, 1984). Faculty evaluation: Surveying policy and practices. *Change, 16,* 28-33.

Sheridan, P.M., & Pyke, S.W. (1994). Predictors of time to completion of graduate degrees. *Canadian Journal of Higher Education, 24*(2), 68-88.

Smith, S.L. (1991). *Report of the Commission of Inquiry on Canadian University Education.* Ottawa: Association of Universities and Colleges of Canada.

Tidball, M. (1986). Baccalaureate origins of recent natural science doctorates. *Journal of Higher Education, 57,* 606-620.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago: University of Chicago Press.

Tromblay, T. (1984). *The effectiveness of faculty advisors: Theory and assessment.* Unpublished doctoral dissertation, McGill University, Montreal.

Tuckman, H.P. (1991) Measuring, understanding and doing something about the rise in doctorate completion time. In J.C. Smart (Ed.), *Higher education: Handbook of theory and research, Vol. VII* (pp. 223-260). New York: Agathon Press.

Winston, R.B., Jr., & Polkosnik, M.C. (1984). Advising graduate and professional school students. In R.B. Winston, Jr., T.K. Miller, S.C. Ender, & T.J. Grites (Eds.), *Developmental academic advising: Addressing students' educational, career, and personal needs* (pp. 287-314). San Francisco: Jossey-Bass.

Worthington, E., & Roehlke, H. (1979). Effective supervision as perceived by beginning counselors-in-training. *Journal of Counselling Psychology, 26*(1), 64-73.

Organization and Administration of Graduate Studies in Canadian Universities

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Abstract

Considerable concern exists in Canada, the United States, and some other western countries about the rates of non-completion of graduate programs and the increasing amount of time needed for completion. A 1990-91 study obtained information and opinions about graduate program practices from samples of department heads and experienced supervisors of graduate students in five Canadian universities. Aspects associated most with successful completion within the universities' time limits were high student motivation, appropriate supervision, careful selection of students, clear definition of research field, and a substantial period of full-time study. The most commonly mentioned reasons provided for non-completion were acceptance of employment prior to completion, inadequate supervision, financial constraints, ill-conceived projects, lack of motivation, and lack of ability.

Résumé

Au Canada, aux États-Unis, et dans certains pays occidentaux, on s'inquiète des taux de diplômation observés dans les programmes de deuxième et troisème cycles, et de l'augmentation de la durée des études. Une enquête portant sur ces questions a recueilli les opinions d'un échantillon de directeurs de département et de professeurs ayant des tâches de direction d'étudiants dans cinq universités canadiennes. Selon cette étude, les facteurs favorisant la diplômation dans les délais prévus par les universités sont une forte motivation de la part de l'étudiant, un encadrement approprié, une attention à la sélection des étudiants, une définition claire du champ de recherche et une période prolongée d'études à plein temps. Parmi les facteurs négatifs cités, notons la décision d'accepter un emploi avant la fin du programme, une encadrement inadéquat, des contraintes financières, des projets mal conçus, un manque de motivation, et des carences au niveau des habiletés.

This paper has two main purposes. First, it presents an overview of some issues and alternative approaches in the organization and administration of graduate studies in universities in Canada and other selected countries. Second, it presents the results of a survey of department heads/chairs/graduate coordinators and experienced graduate supervisors about practices and opinions related to organizational, administrative, and other relevant matters which have been identified in the literature or in discussions on campuses.

Issues and Alternative Approaches

Our current knowledge about the organization and administration of graduate programs is found in two main sources: (a) reports and periodicals (e.g., Canadian Association of Graduate Schools, Statistical Report 1991; and various publications of the Council of Graduate Schools); and (b) manuals of faculties of graduate studies. The information in these publications tends to be of three types: (a) statistical (e.g., enrolment data); (b) expressions of individual opinion; and (c) statements of policies and procedures. No publication exists which synthesizes policies, procedures, opinions, issues, completion rates, and completion times for graduate studies in Canadian universities collectively. Yeates (1992) has, however, recently provided a very useful document which includes Ontario data on these matters.

The last comprehensive examination of Canadian graduate studies was the Canada Council survey conducted by Healy, Dion, and Neatby (1978a & 1978b). That report included these conclusions: (a) "Our experience as a Commission has also alerted us to the importance of research in the area of graduate studies," and (b) we are "woefully ignorant" of "the influence of socio-economic factors on applications for admission to graduate studies" and "the factors affecting the time required to complete a degree" (1978a, p. 95). Several aspects of the organization and administration of graduate studies have received recent attention, as discussed below. Publications by the Royal Society of Canada (1989, 1991), OECD (1987), and the U.K. Economic and Social Research Council (1989a, 1989b, and 1991) attest to the seriousness with which concerns related to graduate studies are being addressed in several countries.

Following analyses of briefs, letters, discussions, and hearings, the University Research Committee of the Royal Society of Canada (1991) prepared 23 recommendations for consideration by governments, the granting councils, the universities, and the Association of Universities and Colleges of Canada. Those directly relevant to this paper are listed below:

12. the Canadian Association of Graduate Schools should propose guidelines to encourage high standards of supervision and speedier completion of programs of graduate study, particularly those leading to doctoral degrees. (p. 29)
13. the granting councils significantly increase the number and value of their doctoral and post-doctoral awards, over the next five years increasing expenditures by SSHRC from the present level of $25 million to $57 million; by NSERC from the present level of $65 million to $100 million; and by MRC from the present level of $20 million to $36 million. (p. 30)
14. the Association of Universities and Colleges of Canada undertake the development of a national assessment guide to graduate programs in Canadian universities. (p. 31)
15. more concerted action be taken by universities to achieve greater collaboration in graduate programs and research, and that both levels of government provide initiatives to speed the process. (p. 32)

Malaney (1988), in his review of "graduate education as an area of research," drew these conclusions: (a) "There has been very little research related to the administration of graduate education" (p. 444); (b) most research related to graduate education is relatively recent and relates mostly to students; (c) the research methods usually involve questionnaires and analysis of students' records; (d) little systematic research has been conducted on graduate student retention; (e) little effort has been made to assess the value and potential of graduate assistantships; and (f) more research has been on doctoral programs than master's programs. He recommended these activities: (a) greater use of personal interviews in research, (b) more aggregation of data and information across institutions, (c) study of the organizational placement of graduate schools and the effectiveness of various structures, and (d) more research on master's students.

With respect to the importance of doctoral programs, Bowen and Rudenstine (1992) claimed that:

> . . . doctoral education occupies a particularly critical place in the overall structure of higher education because it is the training ground for almost all those who become faculty members, as well as for many who pursue other vocations of broad import. (p. xv)

They also observed that graduate education "enjoys enormous prestige and yet it is relatively unexamined and not carefully monitored" and reported that they are aware "how hard it has been to obtain answers to even the most elementary questions concerning graduate education" (p. xv). In attempting to explain why "so little systematic study has been devoted to doctoral education in general," Bowen and Rudenstine (1992) proposed that "particularly daunting conceptual and empirical problems . . . bedevil study of graduate education." Their comments appear to be equally applicable to Canada.

Current Knowledge

Our current knowledge about the organization and administration of graduate studies can be categorized under headings (i)-(viii) below.

(i) *Enrolment trends.* Information about some trends is readily available from the Canadian Association of Graduate Schools (1991) and the Department of the Secretary of State (1990). In 1991, total doctoral enrolment in Canadian universities was 21,709 and total master's enrolment was 59,024, with full-time percentages being markedly different — 81.9% doctoral and 57.5% master's. Graduate enrolment has approximately doubled in 20 years.

(ii) *Importance and purpose of graduate studies.* Graduate education is acknowledged by experts in different countries to be extremely important for national and provincial development, production of highly qualified manpower, and scientific advancement (e.g., OECD, 1987, and Royal Society of Canada, 1991). Also, more employers are requiring graduate degrees. Gordon *et al.* (1990) therefore recommended that we need to be able to accommodate more part-time students, more working adults, more minorities, and more women in graduate programs (p. 1).

(iii) *Place in university structure.* Malaney (1988) concluded that schools/faculties of graduate studies are incorporated into university organizational structures in a variety of ways and that little is known about these structures and "their relative organizational effectiveness" (p. 444). This situation also applies to Canada. Although the role of graduate schools/faculties has been usefully described by Gordon *et al.* (1990, pp. 3-6), no comprehensive statement exists for Canadian universities collectively.

(iv) *Completion rates and times of program completion.* Data on these aspects are available for some jurisdictions and some disciplines (e.g., Yeates, 1991), but no overall Canadian data had been prepared. Expressions of concern are common in various countries about increasing length of time to complete a degree and the high percentages of non-completion (e.g., OECD, 1987; Dahllöf, 1989). Spurr (1970, p. 127) usefully termed these aspects "attrition" and "attenuation." The Canadian Association of Graduate Schools in 1987 expressed concerns over (a) the "excessive and increasing time" needed to finish the PhD in Canada and (b) the "alarming drop-out rate" (Graduate deans unhappy..., 1988). Similarly, Traugott *et al.* (1990) in a Council of Graduate Schools publication stated that "in recent years the total time required to complete the [PhD] degree has tended to expand. The reasons for this tendency need to be studied carefully and controlled where this is feasible" (p. 14). Cude (1991) has recently advocated that better statistics be made available about completion rates and completion times for doctoral students in Canadian universities.

Cude (1987) also stated that the PhD has become "a trap for the candidate and a sinkhole for intellectual resources," and that "inflexible, cumbersome, restrictive and deplorably wasteful" practices are used. In Australia, Moses (1985) observed that "full-time students take longer to complete their PhD than they ought to (in light of university guidelines and funding practices)" (p. 3), that science students complete more quickly than do humanities and social sciences students, and that attrition rates vary between 29% and 48%.

For the United Kingdom, Winfield (1987b) observed that "the doctorate, though important, is also in urgent need of reform" (p. 15), and, after criticizing the length of time taken to complete the PhD, stated that most PhDs in the social sciences could be completed in four years. (This view was supported earlier by Spurr (1970, p. 132) for PhD degrees in the United States.) Winfield reported that a time-limited PhD is being discussed in many countries, notably the United States, France, Sweden, and the Netherlands.

Successful completion of the PhD within a reasonable time has been associated with the following variables: adequate motivation (OECD, 1987; Spurr, 1970); effective supervision (Winfield, 1987a; OECD, 1987; Powles, 1989); full-time study (OECD, 1987); selection and examinations (Task Force..., 1975); financial support (Canadian Association of Graduate Schools, 1987; OECD, 1987); department of study, ethnicity, citizenship, and gender (Zwick, 1991); and careful selection of topic and project (Hamilton *et al.*, 1991, p. 20).

For the University of Toronto, Sheinin (in Filteau, 1989) reported that (a) on average, 60% of male students who commence PhD programs attain the degree compared with 50% of female students, and (b) both men and women had the highest PhD graduation rate in the life sciences and the lowest in the humanities and social sciences. Yeates (1991) provided data which showed that 57.34% of the 1,172 doctoral students who commenced their studies in 10 Ontario universities in the fall of 1980 had obtained the degree in 10 or fewer years; 13% of the 1,172 commencing students withdrew in the first year. No information was provided by Yeates about whether any of these first-year withdrawals were later readmitted.

(v) *Characteristics of graduate students.* Little is known about the characteristics and opinions of Canadian graduate students. We do not have sufficient data about how Canadian graduate students finance their studies, how financial difficulties affect attrition and attenuation, and the effect of perceived financial problems upon enrolment of potential graduate students (Dagg, 1990). Several studies have identified the special problems of female students. For example, Wise (in Filteau, 1989) noted that many women are studying part-time, and that part-time students are not eligible for financial support. Powles (1986) found similar concerns in Australia. Another important aspect involves the characteristics and experiences of international students: they constituted 15.7% of all graduate students in Canadian universities in 1990, with the highest percentage being about 34% of all graduate students in science/engineering (Canadian Association of Graduate Schools, 1991).

(vi) *Review practices.* Reviews of graduate programs, which add to our knowledge (Wilson, 1987), are conducted by many Canadian universities (e.g., Alberta, Calgary, and McGill), but distribution of the reports of such reviews is usually restricted. The Ontario Council on Graduate Studies conducts a unique system of reviews of graduate programs in 15 autonomous universities (Yeates, n.d.; Stewart, 1988).

(vii) *Theses.* Boyer (1990) advocated that "the dissertation, or a comparable project, should continue to be the centerpiece–the intellectual culmination of the graduate experience" (pp. 73-74). The content of theses appears to be left largely to students and their advisory committees. Synthesized information about thesis practices in various programs in Canadian universities is not available. Matters such as length, extent of original contribution, sponsorship, classified research, ethics, joint authorship, and format need to be addressed (Traugott *et al.,* 1990). Several U.S. graduate schools now accept groups of published research papers as an alternative. The nature of the PhD thesis was commonly addressed in the responses to the U.K. Economic and Social Research Council Survey (Smith, 1990). The Council of Graduate Schools (Norris, 1989), being concerned that the average time to complete a PhD is now 7 years compared with 5.5 years in the 1960s, established a task force in 1989 to examine alternatives to the thesis and to assess whether the thesis is "still serving its original purpose of demonstrating the student's ability to carry out independent scholarship" (p. 1). After surveying staff in 46 United States and four Canadian universities, the Council of Graduate Schools (1991) produced a policy statement entitled The Role and Nature of the Doctoral Dissertation which contained these major conclusions: (a) "the doctoral dissertation...defines the essence of the PhD degree"; (b) graduate students in the sciences and engineering often work in research groups and may already have published some results before producing a thesis; (c) students and graduate deans are less satisfied with faculty as advisers than are the faculty themselves; (d) "disciplinary diversity affects all aspects of the role and nature of the doctoral dissertation"; and (e) "new sensitivity is called for in today's complex and changing research environment" (pp. 31-32).

(viii) *Supervisory practices.* Various reports (e.g., Christopherson, 1983; Connell, 1985; Kirkwood, 1985; Powles, 1988; Busch, 1985; and Council of Graduate Schools, 1990) have shown that supervisory practices vary by professor and discipline and that constant, thoughtful supervision is one of the keys to successful graduate program completion. These authors and others (e.g., OECD, 1987; Gordon *et al.*, 1990) have identified desirable aspects of supervision. But we do not have any overview of supervisory approaches used in Canadian universities.

Many other relevant matters are raised in the literature, including (a) concern that graduate students usually do little teaching and that those who do teach are often ill-prepared (e.g., Boyer, 1990), (b) whether only certain appropriately qualified staff members — who may constitute the "graduate faculty" — should be allowed to supervise graduate students (e.g., Gordon *et al.*, 1990), (c) consideration of the quality of graduate teaching and supervision in career decisions (e.g., Gordon *et al.*, 1990), (d) whether dissertations should be publishable (e.g., Hamilton *et al.*, 1991), (e) whether alternative doctorates should be offered (e.g., OECD, 1987; Ontario Council on Graduate Studies, 1990; Yeates, 1991); (f) whether appropriate physical facilities are available for graduate students (Traugott *et al.*, 1990), (g) recognition that graduate program procedures vary among disciplines (Hamilton *et al.*, 1991; Yeates, 1991), (h) publication of papers based on student's research (Council of Graduate Schools, 1990), (i) use of committees rather than a single supervisor (Bowen & Rudenstine, 1991, p. 284), (j) how students' research topics are selected (Hamilton *et al.*, 1991), and (k) consideration of the different characteristics of practice-oriented master's programs (usually non-thesis) and research-oriented master's programs (Palm *et al.*, 1990).

Conceptual Framework

The basic systems model involving inputs, process, outputs, and feedback is probably the most useful and comprehensive approach for study of the organization and administration of graduate studies. Examples of relevant variables, which are mentioned in the literature and university calendars, are listed below:

Inputs – goals of graduate studies, admission requirements, characteristics of students, characteristics of supervisors, numbers of students, resources, research ethos, and financial support.

Process – administration/organization of graduate studies, program requirements (courses, research, examinations), supervisory practices, and formal and informal interactions.

Outputs – completion rates, numbers completing, quality of graduates, research performance, staff and student satisfaction, and university/department reputation.

Feedback – opinions about effectiveness, efficiency, issues, and trends; conclusions from formal graduate program review.

Because not all of these variables could be examined in any one study, emphasis was placed upon selected university inputs, processes, student outputs, and feedback.

Methodology

During 1991, a pilot study was conducted in order to obtain preliminary information about practices in and opinions about the organization and administration of graduate studies in Canadian universities. This study involved the sending of questionnaires to 109 department heads and 149 supervisors across a range of disciplines in five universities — Alberta, Dalhousie, McGill, Saskatchewan, and Toronto. Each graduate dean was asked to provide the names of 20 department heads and 30 experienced supervisors; McGill provided the names of 30 department heads and all of these were approached. The respective overall completion rates by the cut-off date were 86% and 75%, with 94 and 112 respondents respectively; these rates were very high for a study of this type, indicating substantial interest in the topic. Table 1 shows the rates of return for each university, while Table 2 displays information about the department heads' units.

The questionnaires, which were constructed specially for this study, had two main sections: (a) practices involved in administration and organization of graduate programs; and (b) aspects which may increase successful completion of graduate programs. They were

Table 1

Response Percentages for Supervisors and Department Heads

University	Supervisors			Department Heads		
	Sample n	Returned f	Returned %f	Sample n	Returned f	Returned %f
Alberta	29	26	90	18	18	100
Dalhousie	30	21	70	21	19	90
McGill	30	22	73	30	24	80
Toronto	30	18	60	20	15	75
Saskatchewan	30	25	83	20	18	90
TOTAL	**149**	**112**	**75**	**109**	**94**	**86**

Note: The responses from one supervisor and two department heads are not included in the analyses presented in Tables 2 to6.

Table 2

Selected Characteristics of Department Heads' Departments (n=94)

Discipline area	Number of department heads responding[a]	Range of number of FTE staff	Range of numbers of students[b]			
			Doctoral		Master's	
			FT	PT	FT	PT
Humanities	19	7-50	2-87	1-20	5-43	1-20
Life Sciences	29	5-42	3-55	1-3	3-63	2-22
Science & Engineering	26	9-55	6-101	1-10	2-73	1-10
Social Sciences	20	3-36	1-50	1-28	4-114	5-164

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[a] The corresponding numbers of responding supervisors were 20, 25, 39, and 26.

[b] Some departments had no students in some of these categories.

pilot-tested with former department heads and graduate students. With respect to practices, department heads were asked to provide information about current practices and emphasis on selected aspects, and the supervisors to provide opinions on both areas. Questionnaire items related to the following matters which have been identified as relevant either in the literature or in discussions at universities — purpose of graduate studies, course work requirements, involvement of faculty members, information provided to graduate students, facilities for graduate students, program quotas, admissions, nature of PhD thesis, master's non-thesis programs, supervisory committees, financial support, and examinations. A multiple-choice format was used for all questions. For most of the questions dealing with the existence of selected practices, department heads were provided with a "true-undecided-false" scale. However, for similar items, supervisors were asked to select from "agree-undecided-disagree" as such labels were deemed to be more appropriate for assessing attitudes.

For questions dealing with aspects related to successful completion, both department heads and supervisors chose a response from this scale: 1 = not at all; 2 = a little; 3 = some extent; 4 = considerable extent; and 5 = a great deal. Department heads were asked to identify the extent to which they emphasized ten aspects which have been identified in the literature. Supervisors were asked to rate the extent to which they considered 15 aspects — the same ten as in the department heads' questionnaire as well as five others mainly related directly to students — contributed to successful completion.

Both groups were also asked for their opinions about why master's and doctoral students do not complete their programs within their university's time limits. About 90% provided these opinions. Additional comments relevant to the research questions were made by 66 respondents, and 67 gave suggestions about how the questionnaires could be improved.

The multiple-choice questions were analyzed using percentage frequency distributions for the groups overall and for sub-groups categorized by discipline orientation — humanities, life sciences, science and engineering, and social sciences. The free responses were content-analyzed.

Results

Selected Practices

Information about (a) the percentage frequency with which department heads identified the existence of selected practices and (b) the percentage frequency with which supervisors supported selected practices is presented below.

Current situation. As shown in Table 3, the following 10 practices received at least 85% "true" responses and therefore could be considered as "normal practice": taking applicant's academic record into account in the admission decision (100%); taking applicant's references into account in the admission decision (99%); requiring course work of all master's students (99%); making of the admission decision by Faculty of Graduate

Table 3

Practices Involved in Administration of Graduate Programs as Identified by Department Heads (n=94)

Practices	True %	Undecided %	False %	n
Your department offers practitioner doctoral degrees (e.g., Doctor of Education) in addition to the PhD	2	0	98	93
Course work is required of all master's students in your department	99	0	1	94
Course work is required of all doctoral students in your department	87	3	10	78
The number of required courses is varied depending upon the background of each graduate student.	71	2	27	92
Your graduate students are encouraged to take courses outside your department:				
a.) master's students	60	16	24	93
b.) doctoral students	65	9	26	86
The number of independent study/research courses in the program of a graduate student in your department is limited to no more than about 15% of the total number of courses:				
a.) master's students	39	15	46	80
b.) doctoral students	31	18	51	72
All faculty members in your department are normally involved in teaching at least one graduate course in each academic year.	35	3	62	94
All faculty members in your department are normally involved in supervising at least one graduate student in each academic year.	55	3	42	94
A separate "graduate faculty" is established in your department consisting of faculty members whose research and publication records are especially meritorious.	17	2	81	91
Your department provides your graduate students with a list of their responsibilities and duties.	65	11	25	93
All full-time graduate students in your department are provided with appropriate office and/or laboratory space.				
a.) master's students	74	3	23	93
b.) doctoral students	85	2	13	85

Table 3 (cont.)

Practices	True %	Undecided %	False %	n
Your university has established quotas for your graduate programs where the admission demand regularly exceeds the department's capacity.	16	6	79	90
The decision to admit an applicant to a graduate program is the responsibility of the Faculty of Graduate Studies upon the recommendation of your department.	99	0	1	94
Your department has established an Admissions Committee to deal with applications from potential graduate students.	90	1	9	86
The decision of your department to admit an applicant to graduate studies takes into account:				
a.) applicant's academic record	100	0	0	94
b.) applicant's references	99	1	0	94
c.) applicant's work record	60	13	27	90
d.) Miller's Analogies Test or Graduate Record Exam or equivalent	37	7	56	84
a.) The "traditional" type of doctoral thesis remains a requirement in your discipline.	89	1	9	85
b.) The doctoral thesis requirement can be met in your discipline by submission of an acceptable set of interrelated research reports.	21	4	76	82
c.) The doctoral thesis requirement can be met in your discipline by submission of an acceptable set of:				
i.) interrelated articles published in refereed journals	29	10	61	82
ii.) unrelated articles published in refereed journals	7	9	84	77
When appropriate, your PhD students can be enrolled in a program jointly sponsored by another department, with one department having primary administrative responsibility.	76	5	20	86
In your department, master's students are allowed to choose between a thesis program and a non-thesis program.	30	3	67	93
In your department, most master's students select a non-thesis program	15	5	80	80

Table 3 (cont.)

Practices	True %	Undecided %	False %	n
In your discipline, the master's thesis has been eliminated and students' research activity is concentrated mainly in the PhD thesis.	3	3	93	91
In your department, any non-thesis program must include a significant research project.	54	10	36	50
Supervisory committees in your department normally include a faculty member from another department:				
a.) for master's students	33	9	59	92
b.) for doctoral students	54	8	38	85
A list of responsibilities and duties of supervisory committees for graduate students is provided by your department.	63	4	32	93
Your department tries to ensure that all of its full-time graduate students receive some financial support.				
a.) master's	74	8	18	93
b.) doctoral	90	0	10	87
Examinations are normally conducted at the end of every graduate course in your department.				
a.) master's courses	60	5	35	61
b.) doctoral courses	56	7	37	87
Comprehensive examinations are normally conducted in your department before graduate students can progress from the coursework phase to the thesis-work phase of their programs.				
a.) master's program	14	0	86	87
b.) doctoral program	60	0	40	87
Candidacy examinations are normally conducted before doctoral students can progress towards the main part of the thesis phase of their programs in your department.	66	4	30	80
Final oral examinations are conducted by a faculty committee at the end of a graduate student's program in your department.				
a.) non-thesis master's student	19	8	73	52
b.) thesis master's student	63	0	38	88
c.) doctoral student	99	0	1	87

Studies on recommendation of department (99%); holding final oral examinations for all doctoral students (99%); trying to ensure that all full-time doctoral students receive some financial support (90%); using a departmental admissions committee (90%); requiring a "traditional" type of doctoral thesis (89%); requiring course work of all doctoral students (87%); and providing all full-time doctoral students with office and/or laboratory space (85%). What could be called "common practice," i.e., those aspects which obtained "true" responses between 65% and 76%, pertained to seven other aspects: enrolling doctoral students in a program jointly sponsored by another department (76%); providing all full-time master's students with office and/or laboratory space (74%); trying to ensure that all full-time master's students receive some financial support (74%); varying the number of courses required depending on the student's background (71%); holding candidacy examinations before doctoral students can progress to main part of thesis phase (66%); encouraging doctoral students to take courses outside own department (65%); and providing graduate students with a list of their responsibilities and duties (65%). (The term "candidacy examinations" — related to examinations and pertaining to change of status from "probationary candidate" to "candidate" — was not always understood by respondents.)

Some practices were uncommon in the universities sampled. High percentages of "false" responses were obtained for offering of practitioner doctoral degrees (98%), establishment of a separate "graduate faculty" for especially meritorious faculty members (81%), selection by master's students of optional non-thesis programs (80%), establishment of quotas for high-demand graduate programs (79%), holding final oral examinations for non-thesis master's students (73%), and meeting the doctoral thesis requirement by submitting acceptable sets of (a) interrelated research reports (76%), (b) interrelated articles published in refereed journals (61%), and (c) unrelated articles published in refereed journals (84%).

Opinions. As shown in Table 4, at least 85% of the supervisors agreed with the following propositions: the admission decision should take into account the applicant's academic record; the admission decision should take into account the applicant's references; course work should be required of all master's students; all full-time doctoral students should be provided with appropriate office and/or laboratory space; doctoral students could be enrolled in a program jointly sponsored by two departments; final oral examinations should be held for doctoral students; the Faculty of Graduate Studies should be responsible for admission of students on the recommendation of a department; and each department should have an admissions committee.

Comparison. Substantially more support was obtained for the following practices than was obtained for the extent to which they currently exist as assessed by "true" responses of department heads: (a) universities should offer practitioner doctoral degrees in addition to the PhD (36% agree vs. 2% currently exists), and (b) universities should establish quotas for high-demand graduate programs (64% vs. 16%). Somewhat more support was obtained for these two practices: (a) establishment of a separate graduate faculty for especially meritorious faculty members (36% agree vs. 17% currently exists), and

Table 4

Attitudes of Graduate Supervisors Towards Selected Practices Related to Graduate Programs (n=112)

Practices	True %	Undecided %	False %	n
Where resources permit, universities should offer practitioner doctoral degrees (e.g., Doctor of Engineering, Doctor of Education) in addition to the PhD.	36	38	25	107
Course work should be required of all master's students.	97	2	1	111
Course work should be required of all doctoral students.	71	7	22	110
The number of required courses should be varied depending upon the background of each graduate student.	85	5	11	110
Graduate students should be encouraged to take courses outside their own department:				
a.) master's	62	15	23	108
b.) doctoral	75	9	17	106
The number of independent study/research courses in a graduate student's program should be limited to no more than about 15% of the total number of courses:				
a.) master's students	44	20	36	103
b.) doctoral students	30	19	51	102
In departments with graduate programs, all faculty members should normally be involved in teaching at least one graduate course in each academic year.	29	7	64	108
In departments with graduate programs, all faculty members should normally be involved in supervising at least one graduate student in each academic year.	34	5	61	110
A separate "graduate faculty" should be established consisting of faculty members whose research and publication records are especially meritorious.	36	17	47	110
Universities should provide their graduate students with a list of their responsibilities and duties.	79	10	11	108
All full-time graduate students should be provided with appropriate office and/or laboratory space.				
a.) master's students	81	5	14	111
b.) doctoral students	94	3	4	111
Universities should establish quotas for those graduate programs where the admission demand regularly exceeds the department's capacity.	64	14	22	107

Table 4 (cont.)

Practices	True %	Undecided %	False %	n
The decision to admit an applicant to a graduate program should be the responsibility of the Faculty of Graduate Studies upon the recommendation of the department.	91	1	8	110
Each department should establish an Admissions Committee to deal with applications from potential graduate students.	87	6	6	110
The admission decision to graduate studies should take into account:				
a.) applicant's academic record	100	0	0	112
b.) applicant's references	99	0	1	110
c.) applicant's work record	73	18	9	104
d.) Miller's Analogies Test or Graduate Record Exam or equivalent	32	41	27	105
a.) The "traditional" type of doctoral thesis should remain a requirement in your discipline.	76	9	15	108
b.) The doctoral thesis requirement could be met in your discipline by submission of an acceptable set of interrelated research reports.	31	14	55	106
c.) The doctoral thesis requirement could be met in your discipline by submission of an acceptable set of:				
i.) interrelated articles published in refereed journals	51	12	37	107
ii.) unrelated articles published in refereed journals	12	18	70	108
When appropriate, PhD students could be enrolled in a program jointly sponsored by two departments, with one department having primary administrative responsibility.	93	4	4	110
In your discipline, master's students should be allowed to choose between a thesis program and a non-thesis program.	42	9	49	111
In your discipline, the objective of the master's degree would best be met by a non-thesis program	19	12	79	107
In your discipline, the master's thesis should be eliminated and students' research activity should be concentrated mainly in the PhD thesis.	15	8	77	111

Table 4 (cont.)

Practices	True %	Undecided %	False %	n
In your discipline, any non-thesis program should include a significant research project.	69	16	15	100
Supervisory committees should normally be required to include a faculty member from another department:				
a.) for master's students	21	13	66	110
b.) for doctoral students	54	9	37	111
A list of the responsibilities and duties of supervisory committees for graduate students should be provided by your university.	84	6	10	108
Your department should try to ensure that all of its full-time graduate students receive some financial support.				
a.) master's	74	6	19	109
b.) doctoral	89	2	9	109
Examinations should normally be conducted at the end of every graduate course.				
a.) master's courses	56	13	31	108
b.) doctoral courses	50	15	36	109
Comprehensive examinations should normally be conducted before graduate students can progress from the course-work phase to the thesis-work phase of their programs.				
a.) master's program	20	11	69	107
b.) doctoral program	62	6	31	109
Candidacy examinations should normally be conducted before doctoral students can progress towards the main part of the thesis phase of their programs.	60	15	25	106
Final oral examinations should be conducted by a faculty committee at the end of a graduate student's program:				
a.) non-thesis master's student	29	19	52	96
b.) thesis master's student	69	6	26	108
c.) doctoral student	92	3	5	110

(b) the doctoral thesis requirement could be met by an acceptable set of interrelated articles published in refereed journals (51% vs. 29%).

Emphasis on Selected Aspects

This section includes information about (a) the percentage frequency of responses of department heads concerning the extent to which they have emphasized selected aspects — related to admission, program reviews, students, supervision, funding, etc. — in an attempt to increase successful completion of graduate programs, and (b) the percentage frequency with which supervisors supported these selected aspects. The reported means were based on this response scale: 1 = not at all; 2 = a little; 3 = some extent; 4 = considerable extent; and 5 = a great deal.

Current situation. Table 5 presents the means and standard deviations for the responses of department heads. Two major results were obtained. First, the means for actions taken with respect to doctoral students were all higher than were those for master's students, possibly indicating greater attention to the doctoral sector. Second, the means for careful selection of students (master's 4.15; doctoral 4.30), appropriate supervision (4.12; 4.19) and clear definition by students of research field (3.84; 4.13) were somewhat higher than the other means, which ranged from 3.06 to 3.76 (master's) and 3.13 to 4.01 (doctoral). A substantial period of full-time study was also emphasized (3.76 and 4.00), while adequate financial support obtained a doctoral mean of 4.01.

Opinions. The means and standard deviations of the responses of supervisors about the 15 practices are shown in Table 6. Again the means pertinent to doctoral students were higher than those for master's students. The highest means were obtained for high student motivation (master's 4.59; doctoral 4.66), appropriate supervision (4.34; 4.35), and careful selection of students (4.21; 4.33). Other doctoral means higher than 4, which indicated a considerable extent, were recorded for clear definition by students of research field (4.28), mental resilience of students (4.14), confidence of students (4.12), and a substantial period of full-time study (4.03). In contrast, the lowest means were associated with regular program reviews (2.59 master's; 2.70 doctoral), careful testing throughout the program (2.86; 2.92), specification of a maximum period for program completion (2.99, 3.00), and encouragement from family members (3.16; 3.18).

Comparison. When the means for the ten common aspects in Tables 5 and 6 were compared, on only two aspects were the perceived means greater than the actual means. Supervisors' responses for high student motivation as a contributor obtained means of 4.59 (master's) and 4.66 (doctoral) as compared with 3.57 and 3.66 for department heads, while the corresponding figures for high problem-orientation of students were 3.71 and 3.99 compared with 3.06 and 3.13. (Several respondents stated that the term "high problem-orientation" was not clear.) Conversely, whereas regular program reviews had means of 3.42 (master's) and 3.45 (doctoral) with respect to emphasis placed by department heads to increase successful completion, supervisors rated this practice lowest with means of 2.59 and 2.70.

Table 5

Ratings by Department Heads of Extent of Emphasis Placed upon Selected Aspects to Increase Successful Completion of Graduate Programs (n=94)

Aspect	Mean		SD		n	
	Master's	Doctorate	Master's	Doctorate	M	D
Increased admission standards	3.29	3.45	1.16	1.20	89	82
Regular program reviews (e.g., every 3-5 years)	3.42	3.45	1.18	1.18	88	80
High student motivation	3.57	3.66	1.05	1.04	86	80
Appropriate supervision	4.12	4.19	0.77	0.70	87	84
Substantial period of full-time study	3.76	4.00	1.30	1.18	84	79
Careful selection of students	4.15	4.30	0.80	0.75	91	83
Careful testing throughout the program	3.10	3.30	1.19	1.11	87	81
Adequate financial support	3.61	4.01	1.13	1.01	90	83
High problem-orientation of students	3.06	3.13	1.15	1.23	67	63
Clear definition by students of research field	3.84	4.13	1.00	0.86	88	85

Note: Calculation of means was based on responses using this scale:
1=not at all; 2=a little; 3=some extent; 4=considerable extent; 5=a great deal

Reasons for Non-completion Within Time Limit

Both department heads and supervisors were asked to provide "the three most common reasons why your graduate students do not complete their programs within your university's time limit." Separate responses were requested for master's and doctoral students. Replies were received from 84 department heads and 110 supervisors: these were combined and the most frequent replies are displayed in Table 7. Some replied that non-completion either did not occur or was rare in their departments. Others supplied either one or two reasons for master's and/or doctoral students, rather than three.

As shown in Table 7, the six reasons which received at least 25 mentions for master's students were as follows: accept employment prior to program completion; financial constraints; inadequate supervision; lack of motivation, etc.; lack of ability; and an ill-conceived research project. All except lack of ability were also in the six most frequently

Table 6

Ratings by Supervisors of Extent to which Aelected Aspects Contribute to Successful Completion of Graduate Programs (n=112)

Aspect	Mean		SD		n	
	Master's	Doctorate	Master's	Doctorate	M	D
Increased admission standards	3.56	3.72	1.17	1.16	105	105
Regular program reviews (e.g., every 3-5 years)	2.59	2.70	1.09	1.09	107	108
High student motivation	4.59	4.66	0.61	0.53	110	110
Appropriate supervision	4.34	4.35	0.76	0.70	110	110
Substantial period of full-time study	3.83	4.03	1.07	1.02	104	103
Careful selection of students	4.21	4.33	0.85	0.82	108	108
Careful testing throughout the program	2.86	2.92	1.05	1.11	106	105
Adequate financial support	3.66	3.91	1.04	1.01	110	110
High problem-orientation of students	3.71	3.99	0.98	0.97	88	88
Clear definition by students of research field	3.87	4.28	0.97	0.79	104	105
Encouragement of students from family members	3.16	3.18	1.06	1.12	103	103
Mental resilience of students	3.89	4.14	0.85	0.83	104	104
Confidence of students	3.91	4.12	0.85	0.83	107	107
Favorable opinion of students by supervisors	3.48	3.66	0.92	0.90	108	108
Specification of a maximum period for completion of program	2.99	3.00	1.08	1.08	109	109

Note: Calculation of means was based on responses using this scale:
1=not at all; 2=a little; 3=some extent; 4=considerable extent; 5=a great deal

Table 7

Frequency Distributions of Reasons Provided by Department Heads and Supervisors Why Graduate Students do not Complete Programs Within the University's Time Limit

Reason	Master's Students f	Doctoral Students f
Accept employment prior to program completion	55	53
Financial constraints	37	45
Inadequate supervision	36	45
Ill-conceived research project	25	32
Lack of motivation/commitment/resolve/work ethic/industry	36	26
Lack of incentive to complete on time	8	22
Lack of ability	31	20
Personal difficulties, including health	23	19
Family reasons including marriage, pregnancy and change of location	20	19
Overly ambitious research plans of student	15	18
Discouragement during research activity	4	14
Emergence of other interests	15	12
Changes of goals, e.g., transfer to Medicine	14	12
Demands of part-time work	11	12
Difficulties with research project	2	12
Inadequate preparation	17	6

mentioned reasons relevant to doctoral students. These reasons are consistent with those identified in the literature cited earlier (e.g., Canadian Association of Graduate Schools, 1987; OECD, 1987; Powles, 1989; Hamilton *et al.*, 1991;). The frequencies for the reasons listed in Table 7 were very similar for the two degree levels, with the most striking differences between the replies for master's and doctoral students being substantially more frequency of mention for doctoral students of lack of incentive to complete on time (22 doctoral vs. 8 masters), discouragement during research activity (14 vs. 4), and difficulties with research project (12 vs. 2).

Discipline Differences

Space does not permit the inclusion of analyses of answers to all questions for respondents classified by discipline area. The following examples are included to demonstrate that discipline differences appear to exist among supervisors, even though the sub-samples were quite small. Life science respondents showed less agreement with the position that course work should be required of all doctoral students than did respondents in the three other discipline areas — 56% agreed compared with 66% (engineering and science), 89% (humanities), and 77% (social sciences). Also, the social science and life science supervisors agreed to a greater extent with the position that the number of required courses should be varied depending upon the student's background than did respondents for engineering/science and humanities — 100% and 96% vs. 74% and 68%.

Some substantial differences also were found among the responses of the department heads concerning actual practices. For example, when asked whether the number of required courses varied depending upon the student's background, the following percentages answered "true" for the different disciplines — life science (83%), engineering and science (76%), social sciences (63%), and humanities (53%). With respect to the establishment of quotas for high demand programs, the social science department heads indicated that this action was more likely to occur in their discipline area than did the heads in the three other discipline areas — 42% versus 12% (engineering and science), 9% (life sciences), and 6% (humanities). These data support the propositions referred to earlier (e.g., Hamilton *et al.*, 1991; Yeates, 1991) that the graduate experiences vary considerably across disciplines.

Other Matters

Several matters other than those described above were explored in the questionnaires. Some of these are presented below, with the information provided by the department heads integrated with the opinions of supervisors.

Years allowed for program. The most frequent maximum number of years allowed for a doctoral program was six; for master's programs, four and five years were about equally frequent. Responses of supervisors indicated that they would favor a shorter period: five years was the most frequent choice for a post-bachelor's PhD program (38%), four years for a post-master's PhD program (37%), two years for a post-4-years-bachelor's master's program and three years for a post-3-years-bachelor's master's program.

Size of supervisory committee. The most common size of supervisory committee for both master's and doctoral students was reported by department heads to be three: 46% and 48% identified this number. Supervisors tended to agree that three was the desirable number with 53% and 37% choosing three for master's and for doctoral respectively, although 33% favored four for doctoral committees.

Decider of topic for thesis. The current situation in which the topics for both master's and doctoral theses tended to be jointly decided by supervisor and student (75% master's and 86% doctoral) was supported by the supervisor respondents (84% master's and 89% doctoral). Whereas 19% of the department heads reported that topics were normally selected by supervisors, only 12% of supervisors selected this option.

Publication. When asked what would be the common situation with respect to authorship of publications resulting from research in which the supervisors had "considerable involvement," 93% of the department heads identified joint publication by supervisor and student. This position was favored by 87% of the supervisors. When asked the same question but with "little direct involvement," 60% of the department heads selected the student as the sole author and 33% selected joint authorship. For supervisors, the responses were 71% student only and 21% joint.

Candidacy examination. Basing the candidacy examination on both the thesis proposal and course work was reported by 43% of department heads as the normal situation: such an approach received the support of 40% of the supervisors. Basing it mainly on the thesis proposal was the second most common practice with 23% of the department heads selecting this approach: it was supported by 31% of the supervisors. Only 10% or fewer favored basing the candidacy examination either solely on the thesis proposal or solely on course work.

General Comments

The respondents also provided many general comments about the organization and administration of graduate programs. Some of these comments reflected differing opinions, showing that the obtaining of consensus about different issues and practices is unlikely. For example, in one of the universities a respondent recommended that supervisory committees are unnecessary when the supervisor is experienced and successful; others considered that supervisory committees should meet more regularly. Also, while one stated that all graduate theses should be subject to external review, another proposed that graduate programs are restricted by too many rules and regulations. Two professors in that university were especially concerned over the lack of recognition of supervision of graduate students as a part of workload, but most respondents did not address this matter.

Discussion

Detailed discussion of all of the results of this pilot study cannot be included in this brief article. However, some matters warrant special mention. First, the establishment of quotas in high-demand graduate programs was well favored. Second, meeting the doctoral thesis requirement through a set of interrelated articles in refereed journals was supported by half of the supervisors. Third, respondents placed considerable emphasis upon the importance of the following variables for successful completion of graduate programs student motivation, financial support, supervision, project planning, careful student selection, and a period of full-time study. Fourth, differences in some practices and in the perceived effectiveness of these practices seemed to exist among discipline areas. Some of these findings were consistent with those found in the literature cited in the first section of this paper (e.g., variables associated with success) while other findings (e.g., about quotas) are about matters discussed on some campuses but neglected in the literature.

Several other important relevant questions need to be addressed in future research. What major trends in enrolment in master's and doctoral programs in different disciplines are occurring in Canada and in selected other western countries? What are the average completion rates and completion times for graduate programs in different discipline areas? What are the most common ways of incorporating graduate studies into the organizational structure of universities? What linkages exist between the universities' research offices and their faculties/schools of graduate studies? What differences occur in expected and actual supervisory practices among universities, disciplines, and countries? What are the perceived advantages and disadvantages of graduate assistantships? In view of the economic and cultural importance to the nation of graduate studies, and the substantial impact upon individuals' lives of experiences during graduate programs, more detailed examination of this aspect of university operations is certainly warranted.

References

Boyer, E.L. (1990). *Scholarship revisited.* Princeton, NJ: The Carnegie Foundation for the Advancement of Teaching.

Bowen, W.G., & Rudenstine, N.L. (1992). *In pursuit of the PhD.* Princeton, NJ: Princeton University Press.

Busch, J.W. (1985). Mentoring in graduate schools of education: Mentors' perceptions. *American Educational Research Journal, 22*(2), 257-265.

Canadian Association of Graduate Schools. (1991). *Statistical report 1991.* (Prepared by C. Sharpe, Memorial University of Newfoundland.) St. John's, NF: Author.

Christopherson, D. *et al.* (1983). *Research student and supervisor: An approach to good supervisory practice.* Swindon, England: Science and Engineering Research Council.

Connell, R. (1985). How to supervise a PhD. *The Australian Universities' Review, 28*(2), 38-41.

Council of Graduate Schools. (1990). *Research student and supervisor.* Washington, DC: Author.

Council of Graduate Schools. (1991). *The role and nature of the doctoral dissertation.* Washington, DC: Author.

Cude, W. (1987). *The PhD trap.* West Bay, NS: Medicine Label.

Cude, W. (1991). The need for improved doctoral program statistics. *The Canadian Journal of Higher Education, 21*(1), 1-12.

Dagg, A.I. (1990). Squeezing out graduate options. *University Affairs, 31*(7), 21.

Dahllöf, U. (1989). Doctoral studies and public policies affecting the labour market for PhDs in Norway and Sweden. *Scandinavian Journal of Educational Research, 33*(3), 165-184.

Department of the Secretary of State of Canada. (1990). Profile of higher education in *Canada.* Ottawa, ON: Author.

Economic and Social Research Council. (1989a). *Annual Report 1988-89.* Swindon, England: Author.

Economic and Social Research Council. (1989b). *Discussion paper on research training for the 1990s.* Swindon, England: Author.

Economic and Social Research Council. (1991). *Postgraduate training: Guidelines.* Swindon, England: Author.

Filteau, C. (1989). *Proceedings of a conference on women in graduate studies in Ontario.* Toronto, ON: Ontario Council on Graduate Studies.

Gordon, R.E., Baker, M., Croft, R.A., D'Arms, J.H. Dimminie, C.B., & Sheridan, J..D. (1990). *Organization and administration of graduate education.* Washington, DC: Council of Graduate Schools.

Graduate deans unhappy about time taken to finish degrees. (1988, March). *University Affairs,* p. 9.

Hamilton, R.G., Baranger, E., Casarett, A.P., Horowitz, F.D., Koenigsknecht, R.A., Lawrence, F.L., Maclachlan, G., Perkins, F.E., & Traugott, E.C. (1991). *The role and nature of the doctoral dissertation.* Washington, DC: Council of Graduate Schools.

Healy, D., Dion, C., & Neatby, B. (1978a). *Report of the commission on graduate studies in the humanities and social sciences: Summary.* Ottawa, ON: The Canada Council.

Healy, D., Dion, C., & Neatby, B. (1978b). *Report of the commission on graduate studies in the humanities and social sciences.* Ottawa, ON: The Canada Council.

Kirkwood, R. (1985). The quest for quality in graduate education. *Educational Record, 66*(3), 4-8.

Malaney, G.D. (1988). Graduate education as an area of research in the field of higher education. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research*, Vol. 4 (pp. 397-454). New York: Agathon.

Moses, I. (1985). *Supervising postgraduates.* Sydney, Australia: Higher Education Research and Development Society of Australasia.

Norris, W. (1989, 26 May). Time up for PhD thesis. *The Times Higher Education Supplement,* pp. 1 and 11.

Ontario Council on Graduate Studies. (1990). *Education: Comments arising from the appraisal of graduate programs in Ontario.* Toronto, ON: Council of Ontario Universities.

Organization for Economic Co-operation and Development. (1987). *Post-graduate education in the 1980s.* Paris: Author.

Palm, R., Baker, M.J., Goldenberg, R.E., Hiiemae, K., Powell, R.E., & Yeates, M. (1990). *Academic review of graduate programs.* Washington, DC: Council of Graduate Schools.

Powles, M. (1986). Chips in the academic wall: Women and postgraduate study. *The Australian Universities Review, 29*(2), 33-37.

Powles, M. (1988). *Know your PhD students and how to help them.* Melbourne, Australia: Centre for the Study of Higher Education, University of Melbourne.

Powles, M. (1989). *How's the thesis going? Former postgraduates' and their supervisors' views on completion times and dropout.* Melbourne, Australia: Centre for the Study of Higher Education, University of Melbourne.

The Royal Society of Canada. (1989). *A study of university research in Canada: The issues.* Vancouver, BC: Evaluation Research Unit, University of British Columbia.

The Royal Society of Canada. (1991). *Realizing the potential: A strategy for university research in Canada.* Ottawa, ON: Author.

Smith, A. (1990, May). Postgraduate training: The green paper response. *Social Sciences: News from the ESRC (Economic and Social Research Council, Swindon, England),* 5:1-8.

Spurr, S.H. (1970). *Academic degree structures: Innovative structures.* New York: McGraw-Hill.

Stewart, H.B. (1988). *The development of graduate studies in Ontario universities between 1960 and 1985.* Toronto, ON: Council of Ontario Universities.

Task Force [Canada Council] on Graduate Studies and Research in the Humanities and Social Sciences. (1975). *A commitment to excellence.* Kingston, ON: Queen's University.

Traugott, E.C., Catania, F.J., Livingston, W.S., Lockhart, M.M., & Suedfeld, P. (1990). *The Doctor of Philosophy degree.* Washington, DC: Council of Graduate Schools.

Wilson, E.K. (1987). Department reviews for product improvement in higher education. In J.C. Smart (Ed.), *Higher education: Handbook of theory and research,* Vol. 3 (pp. 199-241). New York: Agathon.

Winfield, G. (1987a). *The social science PhD.* London: Economic and Social Research Council.

Winfield, G. (1987b, 27 March). Doctors fighting with an octopus. *The Times Higher Education Supplement,* p. 15.

Yeates, M. (n.d.) *The graduate appraisal process in Ontario.* Toronto, ON: Ontario Council on Graduate Studies.

Yeates, M. (1991). *Doctoral graduation rates in Ontario universities: A discussion paper.* Toronto, ON: Ontario Council on Graduate Studies.

Zwick, R. (1991, April). *Factors contributing to persistence in graduate school.* Paper presented at annual meeting of the American Educational Research Association, Chicago.

Supervision of Graduate Students

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Abstract

Graduate education is an essential component of universities; it also contributes substantially to national economies. However, problems in graduate education, especially with respect to completion and quality, have emerged in many countries, including Canada. To address these problems and related issues and practices, a comprehensive three-year research project has been conducted involving questionnaires and interviews in Canada, Australia, Great Britain, and other countries. This paper presents information from questionnaires completed in 1993 by 736 supervisors of graduate students in 37 universities across Canada. Many substantial differences were obtained between the means for items when respondents were classified into eight discipline areas. The responses related to master's and doctoral programs were generally similar.

Résumé

Les études de 2e et 3e cycles constituent une composante essentielle des programmes offerts par les universités. En outre, ces programmes d'études supérieures contribuent de façon subtantielle aux économies nationales. Tout récemment, les problèmes liés à ces programmes d'études ont fait surface dans plusieurs pays dont le Canada. On s'interroge surtout sur la qualité de ces programmes et la durée requise pour les compléter. Pour répondre à ces interrogations d'ordre général et pratique, nous avons mené une importante recherche qui a duré trois ans et qui s'est étendue à plusieurs pays dont le Canada, l'Australie, la Grande Bretagne, et plusieurs autres. La cueillette des données s'est faite à l'aide de questionnaires et d'entrevues.

Cet article fait état des résultats obtenus à l'aide de questionnaires administrés en 1993 auprès de 736 directeurs d'études supérieures dans 37 universités canadiennes. Ces résultats ont révélé des différences significatives quant aux moyennes obtenues sur chacun des items lorsque les répondants étaient regroupés en 8 secteurs disciplinaires. En ce qui a trait aux programmes de maîtrise et de doctorat, les réponses aux questions étaient assez semblables.

Graduate education is viewed in many countries as essential for the viability of universities and national economies. However, some major problems have been identified in graduate education, especially with respect to (a) completion times and percentages, and (b) the quality of programs and students. Procedures and practices related to these problems have received attention, especially with respect to supervision, funding of students, program requirements, and facilities. Canadian concerns about problems with graduate education, especially long completion times, have been expressed by The Royal Society of Canada (1991), the Canadian Association for Graduate Studies (1992), the Association of Universities and Colleges of Canada (1992), and Stuart Smith (1991).

This article presents the results of analyses of some information obtained during the second part of a research program on the organization and administration of graduate programs. The purpose of the research was to obtain the opinions of experienced supervisors of graduate students about matters identified as important either in the literature or in interviews conducted earlier in the research program. Responses were also classified by (a) eight discipline areas and (b) whether they related to master's or doctoral programs.

Overview of Literature

A considerable body of international literature now exists on supervision of graduate students. Some of this is based on research, such as surveys completed by supervisors and students, while other writings involve learned opinion related to supervisory experience. Research and experience have identified differences in graduate education relevant to the discipline being studied and researched, whether the students are full-time or part-time, and the extent to which graduate education is directed at professional education or the preparation of academics/researchers.

At the outset, the two aspects of supervision described by the Council of Graduate Schools (1990) should be mentioned. The first, dealing with "creativity," was defined as "the ability to select problems, to stimulate and enthuse students, and to provide a steady stream of ideas," while the second involves "the mechanics of ensuring that the student makes steady progress" (p. 1). The selected quotations in this article demonstrate both the importance and the diversity of the graduate supervisor's role.

Creativity, Mentoring, and Support

Blume (1987) addressed the apprenticeship aspect of graduate studies which has found favor among several writers in this way: "The supervisory relationship must be significantly based in the moral and collegial responsibilities of the old system of apprenticeship in scholarship" (p. 15). This relationship has been tied by Moses (1985) to the matter of mutual expectations:

> In my survey of supervisors and postgraduate research students in one [Australian] science department concerning their expectations of each other, supervisors expected students to be diligent, dedicated, and hard working; to be energetic, keen, tenacious, conscientious, and have a sense of urgency. They also expected students to be enthusiastic and motivated towards research work, be pleasant at work and contribute to a good work environment. Students expected their supervisors foremost to have knowledge and ability to supervise that particular area of research, secondly to be reasonable, serious, supporting the student's work in good times and bad, and to be understanding and approachable. (p. 37)

Based on 781 interviews with university administrators, faculty, students, alumni, and employers of graduates from 47 master's programs in the U.S., Conrad, Haworth, and Millar (1993) concluded that active faculty involvement, unity of purpose, strong program leadership, and a supportive learning environment were some of the attributes of high-quality master's programs. The supportive aspect was also addressed by Moses (1992) who considered that supervisors should act as mentors and that a mentoring relationship requires mutual respect based on high academic standards, similar interests, assistance, support, and regular contact (p. 15). However, Gumport (1993) observed that because many graduate students are involved with sponsored research projects, their supervisors are more like project managers than mentors, and consequently the students are treated more like employees than apprentices (p. 241).

The importance of interpersonal relations in graduate supervision was stated more directly by Ballard and Clanchy (1993):

> Successful supervision of graduate students always involves a blend of academic expertise and the skillful management of personal and professional relations. Supervisors are expected to be knowledgeable and skilled in their disciplinary specialties, and they are also expected to take the lead in establishing a quality of relations which will give their students access to the knowledge and skills they possess. This second expectation takes on both a new dimension and a greater intensity in the supervision of overseas or international students. (p. 61)

Similarly, Salmon (1992) brought attention to the importance of the human aspect of supervision when she stated that "the quality that supervision needs above all to offer is that of personal support" (p. 20).

The balance between use of a directive supervisory style and graduate student independence was addressed by Hill, Acker, and Black (1994). In their study of supervisory practices in three U.K. universities they noted substantial variation between the emphasis placed by individual supervisors on direction versus independence. Also, Burgess, Pole, and Hockey (1994) concluded that "most supervisors adopt a degree of flexibility in their approach to supervision in an attempt to meet the needs of individual students" (p. 26). Based on their research in nine U.K. universities, they considered that the approach taken to supervision depends on the supervisor's assessment of the student's intellectual capacity, the supervisor's own doctoral experience, the student's expertise, and the stage of the thesis research.

After reflecting upon their experiences and research findings in U.K. universities, Phillips and Pugh (1987) advised supervisors to take these actions: (a) be aware of students' expectations and try to fulfill them; (b) be aware that you inevitably act as a role model; (c) be aware that supervision is an educational process that requires careful planning; (d) keep students' morale high; (e) set up a helpful climate in which agreements are outlined; and (f) look for ways to support graduate students in their careers (pp. 119-120).

Procedures to Ensure Progress

Several writers have encouraged the holding of regular meetings of supervisors and their graduate students. For example, Bowen and Rudenstine (1992) highlighted this aspect together with the need to establish a schedule:

> It would be difficult to overemphasize the need for regular, scheduled meetings between students and dissertation advisers (or committees) throughout the process, with clear expectations about a work schedule and a timetable for completion of drafts. Faculty must take the initiative in creating and managing this process or structure. Otherwise, many students will drift, or simply be lost. (p. 284)

The need to have a completion schedule was also emphasized by Smith (1991) in his report to the Association of Universities and Colleges of Canada:

> Supervisors should be required to report to their departments the exact status of each graduate student, the schedule for completion (with precise milestones) and the reasons for any changes in the scheduling. Each report should be reviewed by the graduate student and be approved by him/her. Departments should hold supervisors responsible for bringing about timely outcomes as predicted. (p. 107)

Further, based on her research at The University of Melbourne, Powles (1989) identified the need for regular reporting:

> In general, the more input supervisors said they had, the higher their students' satisfaction ratings. Much emphasis was placed by students and supervisors on the importance and usefulness of regular progress reporting either in the form of written submissions or oral reports of a formal (seminar-type) kind. Arts candidates have never done the latter in a majority of cases. (p. 51)

Powles (1993) also pointed out that increasing graduate enrolments and the need to improve the quality of graduate supervision require the use of "advisers with some expertise on supervisory matters" and that "it is widely recognized that being in command of one's field and being an active researcher with a PhD oneself are essential pre-requisites, but these do not guarantee good supervisory practice" (p. 79). The need to insist on higher standards of graduate supervisors, especially to reduce completion times, was recommended by The Royal Society of Canada (1991). Bowen and Rudenstine (1992) considered that thesis advisers "should be evaluated with respect to their performance as advisers" and that "it is difficult to think of responsibilities that are more important than dissertation advising, and the case for careful, and sensitive, evaluation seems compelling" (p. 284).

The amount of assistance given to graduate students by their supervisors varies depending upon the stage that the students have reached. Moses (1992) identified the early and late stages as the most crucial and also stated that "students need guidance in particular on when to stop data collection and analysis, and when to start drafting the thesis, and assistance with structuring of the thesis" (p. 14). Salmon (1992) also advocated that graduate students need substantial help in achieving an appropriate orientation to the final oral examination (p. 28).

Some Canadian universities are focusing attention on the nature and quality of graduate supervision on their campuses. For example, Donald, Saroyan, and Denison (1994) conducted a study at McGill University to identify salient issues and to examine (a) policies relevant to assignment of supervisors, collaboration, and financial assistance, and (b) the importance attributed to academic advising.

Differences Among Disciplines

A few writers have identified differences in practices among disciplines with respect to graduate studies. For example, Moses (1992) had this assessment:

> The role of the supervisor(s) in the selection of the topic varies between broad fields of study; in some areas, notably the humanities, some supervisors would argue that topics should not be assigned to students, but that students should choose supervisor and topic. In other areas, notably those with external funding for projects and team research, suggestions to students about both supervisor and topic is more likely to occur. But in no field was it seen as good practice to assign a topic to students, nor to allow students to choose a topic without having discussed its feasibility and viability with their supervisor. (p. 11)

Donald *et al.* (1994) confirmed that some important differences do exist between discipline areas with respect to supervisory practices. For example, they concluded that at McGill University "in the physical and biological sciences . . . knowledge of the research field is the paramount requirement of a supervisor, while in others, responsiveness to students (availability, motivation, sensitivity) takes precedence" (p. 18).

After surveying aspects of graduate education in Canadian universities, Holdaway, Deblois, and Winchester (1994) reported several differences between disciplines. The most notable were, first, transfer to a doctoral program without completing the master's program is substantially more common in Medicine, Biology, and Physical Sciences than in other discipline areas. Second, in Education, Social Sciences, and Humanities, graduate students choose their thesis topic themselves more frequently than do other students. Third, Humanities graduates were far more likely to have been the sole author of publications resulting from their research than were graduates in the other discipline areas. Finally, lack of financial support was perceived to be a reason for non-completion of graduate students in Humanities far more commonly than for other students.

Synthesis

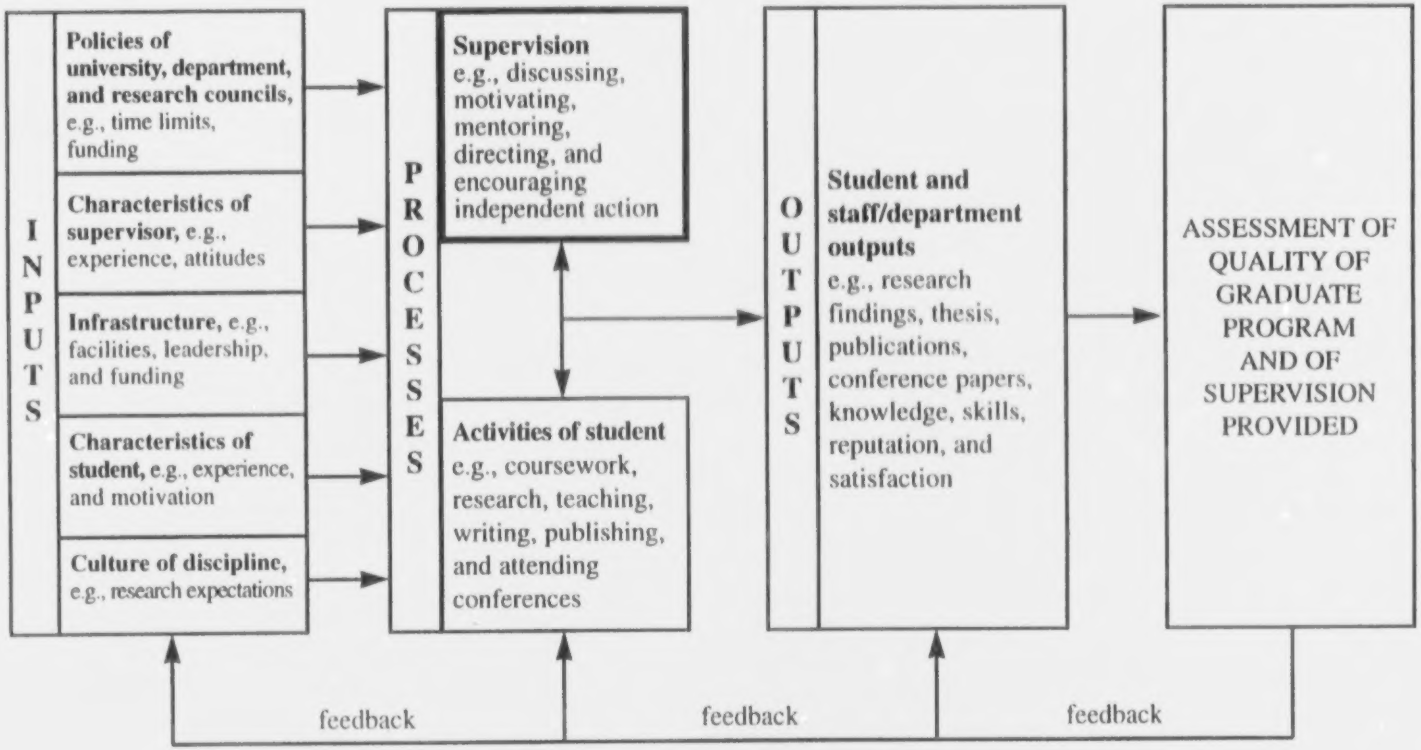
In the U.K. Science and Engineering Research Council publication entitled *Checklist on good supervisory practice,* Christopherson *et al.* (1992) contributed a synthesis of many of the aspects raised in the literature cited above. This publication emphasized distribution of a departmental document on good supervisory practice, a good student-supervisor match, regular reporting and discussions, public presentations, early topic selection, research program with a critical path, checks on student's record keeping, completion of research in three years, and holding of a mock final oral examination. Further synthesis is provided by the conceptual framework in Figure 1 which demonstrates the linkage between some aspects of inputs, process (supervision and activities of student), outputs, assessment of quality of graduate program, and feedback.

Method

In one of the early phases of this study, graduate deans (or equivalent) in 38 Canadian universities were asked to supply information about aspects of the organization and administration of graduate programs. Most of the 37 universities from which information was obtained were used in later phases of the study together with three other universities. In 1992, comprehensive questionnaires were mailed to 892 coordinators of graduate programs in 37 Canadian universities. These programs constituted all of the Canadian graduate programs which were estimated to have at least 20 graduate students. Of the 892 approached, 582 returned completed usable questionnaires for a 65% return rate. The graduate coordinators were also asked to identify two experienced graduate supervisors who were likely to be on campus in 1993-94. A total of 1,100 experienced supervisors were so identified. Comprehensive questionnaires were mailed in early 1993 to these 1,100 supervisors of graduate programs in the 37 Canadian universities; 736 usable responses were obtained. Respondents indicated that 35 supervisors either had been incorrectly identified or were no longer on campus. Based on 1,065 eligible supervisors (1,100 minus 35) the response rate was 69%.

Figure 1

Relationships among selected variables in graduate education relevant to supervision.


INPUTS
Policies of university, department, and research councils, e.g., time limits, funding
Characteristics of supervisor, e.g., experience, attitudes
Infrastructure, e.g., facilities, leadership, and funding
Characteristics of student, e.g., experience, and motivation
Culture of discipline, e.g., research expectations
PROCESSES
Supervision e.g., discussing, motivating, mentoring, directing, and encouraging independent action
Activities of student e.g., coursework, research, teaching, writing, publishing, and attending conferences
OUTPUTS
Student and staff/department outputs e.g., research findings, thesis, publications, conference papers, knowledge, skills, reputation, and satisfaction
ASSESSMENT OF QUALITY OF GRADUATE PROGRAM AND OF SUPERVISION PROVIDED
feedback
feedback
feedback

Information was sought from these "experienced supervisors" about selection of supervisors, supervisory practices, supervisory load, assistance with students in various phases of their research, development of students' skills, and assistance with manuscripts and conference proposals. The questions which had numerical/descriptive response categories (e.g., 5 = "Always") were based upon opinions, practices, and issues which either were raised in the literature cited above or were identified in interviews conducted in earlier phases of this study. Free responses were also invited on any relevant aspect. Pilot-testing of the draft questionnaire resulted in several modifications. Descriptive statistics were used in the analyses, and responses were categorized by major discipline area and by master's or doctoral program.

Inferential statistics were not used because the experienced supervisors who responded were not a representative sample of all Canadian graduate supervisors. Differences between means could therefore not be tested for statistical significance. For differences between percentages on the 1-5 scales to be considered "Substantial" an arbitrary difference of 0.30 above or below the mean was set. Similarly, gross differences in percentages of agreement with propositions (e.g., 65% vs. 35%) were assumed to indicate real differences in attitude between disciplines. Some generalizations about each of the eight discipline areas were then developed based upon both similarities and differences in the supervisors' responses. Of course, the data in Tables 2 to 5 can be analyzed in different ways using different criteria to indicate the extent to which substantial variation occurred between disciplines. The major original contribution of this paper is the provision of data about the opinions of expert supervisors in various discipline areas.

Respondents

The percentage frequency distribution of the respondents' discipline areas is shown in Table 1. In order of decreasing frequency of respondents the major disciplinary areas were Social Sciences 19.2%, Biology 17.8%, Humanities 14.9%, Education 12.6%, Health 11.4%, Physical Sciences 11.4%, Engineering 9.4%, Business 2.9%, and Interdisciplinary 0.6%. The percentage frequency distribution of geographic regions of respondents was as follows: (a) Newfoundland, Nova Scotia, and New Brunswick – 12.1%; (b) Québec – 25.2%; (c) Ontario – 33.2%; and (d) Manitoba, Saskatchewan, Alberta, and British Columbia – 29.4%. Geographic location was not used in the analyses.

Results

Selected representative results obtained from the questionnaires are presented below using these approaches: (a) presentation of overall means or overall percentages; (b) comparison of means or percentages for the responses classified by the major discipline groups; and (c) comparison of means or percentages of responses relevant to master's and doctoral programs. Selected illustrative quotations from the respondents' comments provided on the questionnaires are interspersed in italics. The quotations were selected

Table 1

Percentage Frequency Distribution of Academic Disciplines of Respondents (n=727)

Academic discipline	%f	Total %f
BIOLOGY		
Agriculture, Forestry, and/or Biological Sciences	17.2	
Veterinary Medicine	0.6	17.8
ENGINEERING		
Architecture	0.7	
Engineering	8.7	9.4
BUSINESS		
Business/Commerce	1.8	
Public Administration	1.1	2.9
PHYSICAL SCIENCES		
Physical Sciences	8.1	
Computing Science	2.1	
Mathematics and/or Statistics	1.2	11.4
HEALTH		
Dentistry	0.8	
Medicine	6.3	
Nursing	1.8	
Pharmacy	1.5	
Rehabilitation Medicine	1.0	11.4
EDUCATION		
Education	10.5	
Physical Education and/or Recreation	2.1	12.6
SOCIAL SCIENCES		
Social Sciences	11.4	
Home Economics	0.6	
Law	1.2	
Library Science	0.8	
Psychology	3.7	
Social Work	1.5	19.2
HUMANITIES		
Humanities	13.2	
Fine Arts	1.7	14.9
INTERDISCIPLINARY	0.6	0.6

Table 2

Means of Responses of Supervisors, Classified by Major Discipline Areas, to Selected Questions About Supervisory Relationships

QUESTION	Level	Means of Responses								n	Mean
		Biol	Eng	Bus	PhySci	Health	Ed	SocSci	Hum		Total
1. To what extent should faculty members of your academic unit, through courses, seminars, discussions and other activities, assist their students in development of their thesis research proposals?	Master's	4.46	4.25	3.85	4.38	4.39	4.15	4.13	3.99	715	4.23
	Doctoral	4.08	3.84	3.69	4.19	4.00	4.06	3.91	3.97	679	4.00
2. To what extent do you consider that supervisors should assist their graduate students in collection of data for their theses?	Master's	3.01	2.93	2.30	3.28	2.77	2.21	2.50	2.42	691	2.70
	Doctoral	2.66	2.60	2.25	2.95	2.23	2.01	2.23	2.28	664	2.41
3. To what extent do you consider that supervisors should assist their graduate students in analyses of data for their theses?	Master's	3.53	3.37	2.95	3.51	3.73	3.19	3.07	3.15	697	3.33
	Doctoral	3.07	2.84	2.75	3.01	3.09	2.84	2.67	2.94	670	2.92
4. To what extent do you consider that supervisors should be involved in assisting their graduate students in the refinement and improvement of their theses prior to the final oral examination?	Master's	4.10	3.87	4.20	4.16	4.16	4.09	3.96	4.05	705	4.06
	Doctoral	3.73	3.51	4.13	3.93	3.74	3.94	3.78	3.96	687	3.82

Table 2 (cont.)

QUESTION	Level	Means of Responses								n	Mean
		Biol	Eng	Bus	PhySci	Health	Ed	SocSci	Hum		Total
5. To what extent do you consider that universities should assist doctoral students in development of their teaching skills?	Doctoral	3.64	3.39	3.67	3.48	3.59	3.50	3.50	3.82	704	3.58
6. To what extent do you consider that supervisors should assist doctoral students in development of their skills in preparing research grant applications?	Doctoral	3.55	2.82	3.38	3.12	3.86	3.66	3.45	3.66	702	3.48
7. To what extent do you consider that supervisors should assist doctoral students in preparation of proposals to present papers at conferences?	Doctoral	3.94	3.65	3.57	3.91	4.07	3.64	3.33	3.47	707	3.69
8. To what extent do you consider that supervisors should assist doctoral students in preparation of manuscripts for submission to refereed journals?	Doctoral	4.23	3.91	3.71	4.15	4.23	3.69	3.39	3.44	711	3.83
9. To what extent does agreement exist between the expectations of supervisors and graduate students concerning the quality of thesis supervision provided in your academic unit?	Master's	3.90	3.67	3.50	4.01	3.84	3.78	3.69	3.67	618	3.79
	Doctoral	3.94	3.64	3.46	3.99	3.78	3.70	3.70	3.63	549	3.77

Note: These questions used this response scale: 1=Not at all; 2=A little; 3=Some; 4=Substantial; 5=A great deal; (9=Not applicable or No opinion).

Table 3

Means of Responses of Supervisors, Classified by Major Discipline Areas, to Selected Questions About the Importance of University-Level Aspects of Supervision in Assisting Thesis Students to Complete Theses and Pass Final Oral Examinations in an Appropriate Period of Time

Aspect of supervision		Means of Responses								n	Mean
		Biol	Eng	Bus	PhySci	Health	Ed	SocSci	Hum		
	Range of number of responses	120-126	61-66	16-21	78-82	74-82	75-90	102-118	109-114		Total
1. Appoint an appropriate administrator to monitor the supervision provided to all graduate students	Master's	2.87	2.23	3.33	2.61	2.71	2.89	2.65	2.77	688	2.73
	Doctoral	2.84	2.25	3.19	2.56	2.81	2.84	2.64	2.78	635	2.71
2. Require that annual reports of students' progress be submitted to the graduate studies office/faculty	Master's	3.19	2.61	3.24	2.74	2.94	3.03	3.24	2.92	699	3.00
	Doctoral	3.23	2.79	3.25	2.94	2.97	3.16	3.32	3.13	651	3.11

Note: The response categories were 1=None; 2=A little; 3=Some; 4=Considerable; and 5=Great; (9=Not applicable or No opinion).

Table 4

Means of Responses of Supervisors, Classified by Major Discipline Areas, to Selected Questions About the Importance of Unit-Level Aspects of Supervision in Assisting Thesis Students to Complete Theses and Pass Final Oral Examinations in an Appropriate Period of Time

Aspect of supervision		Means of Responses								n	Mean Total
		Biol	Eng	Bus	PhySci	Health	Ed	SocSci	Hum		
	Range of number of responses	113-129	62-68	15-21	75-83	70-82	73-91	100-121	102-117		
1. Assign supervisors at the beginning of students' programs	Master's	4.40	4.18	3.14	3.86	3.87	3.73	3.65	3.49	691	3.85
	Doctoral	4.44	4.22	3.19	3.92	4.18	4.03	3.75	3.68	640	4.00
2. Assign supervisors who are expert in the students' specific research fields	Master's	4.38	4.33	4.00	4.22	4.03	3.76	3.78	4.00	688	4.06
	Doctoral	4.45	4.40	4.40	4.36	4.33	4.15	4.11	4.29	638	4.30
3. Match personalities of supervisors and students	Master's	2.64	2.73	3.16	2.89	2.94	2.96	2.97	3.15	666	2.91
	Doctoral	2.68	2.83	3.33	2.87	3.06	3.12	2.90	3.16	613	2.95
4. Provide a graduate student handbook which includes program procedures, responsibilities of graduate students and supervisors, funding available, and publication policies	Master's	4.16	4.06	4.14	4.00	4.11	4.25	4.14	4.24	707	4.15
	Doctoral	4.13	4.00	4.13	4.07	4.05	4.16	4.20	4.28	655	4.14
5. Involve one or two other faculty members in the student's research throughout the thesis project	Master's	3.88	2.59	3.35	2.95	3.43	3.37	3.41	3.02	693	3.30
	Doctoral	3.96	3.19	3.56	3.38	3.85	3.86	3.72	3.38	650	3.64
6. Provide settings in which students can present progress reports to faculty members and other graduate students for feedback	Master's	4.42	3.71	3.85	3.79	4.22	3.74	3.70	3.62	708	3.90
	Doctoral	4.48	3.91	4.31	4.21	4.44	4.10	3.98	3.90	661	4.16

Note: The response categories were 1=None; 2=A little; 3=Some; 4=Considerable; and 5=Great; (9=Not applicable or No opinion).

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Table 5

Means of Responses of Supervisors, Classified by Major Discipline Areas, to Selected Questions About the Importance of Supervisor-Level Aspects of Supervision in Assisting Thesis Students to Complete Theses and Pass Final Oral Examinations in an Appropriate Period of Time

Aspect of supervision	Range of number of responses	Means of Responses								n	Mean Total
		Biol 110-129	Eng 53-68	Bus 15-21	PhySci 74-83	Health 70-83	Ed 71-91	SocSci 98-122	Hum 101-118		
1. Provide a balance between supervisor's direction and student's independence	Master's	4.21	3.79	4.24	3.91	4.10	4.26	4.08	4.24	695	4.11
	Doctoral	4.46	4.16	4.25	4.18	4.42	4.43	4.28	4.42	647	4.35
2. Ensure that students continually make progress	Master's	4.48	4.27	4.43	4.14	4.24	4.13	4.05	4.10	697	4.21
	Doctoral	4.38	4.22	4.19	4.10	4.20	4.04	3.97	4.15	646	4.16
3. Motivate the students continually	Master's	4.01	3.91	3.85	3.45	3.66	3.41	3.38	3.49	705	3.62
	Doctoral	3.86	3.65	3.73	3.33	3.52	3.13	3.13	3.41	654	3.45
4. Provide personal counselling	Master's	3.30	3.41	3.48	3.07	3.31	2.98	2.86	3.27	694	3.17
	Doctoral	3.26	3.35	3.50	3.10	3.20	2.99	2.69	3.23	640	3.12
5. Encourage students to use methodologies with which students are comfortable	Master's	3.07	3.23	3.65	2.87	3.18	3.75	3.13	3.78	642	3.31
	Doctoral	2.96	3.11	3.40	2.92	3.00	3.68	3.07	3.78	595	3.23
6. Ensure that the thesis project does not grow excessively	Master's	4.32	4.37	4.67	4.05	4.34	4.50	4.44	4.59	708	4.39
	Doctoral	4.13	4.15	4.44	4.04	4.17	4.30	4.28	4.60	661	4.26
7. Help students revise research design if unforeseen problems require such revision	Master's	4.57	4.30	4.33	4.32	4.38	4.41	4.16	4.41	707	4.37
	Doctoral	4.49	4.17	4.19	4.16	4.27	4.36	4.00	4.42	659	4.28

Table 5 (cont.)

Aspect of supervision	Range of number of responses	Means of Responses								n	Mean Total
		Biol	Eng	Bus	PhySci	Health	Ed	SocSci	Hum		
		110-129	53-68	15-21	74-83	70-83	71-91	98-122	101-118		
8. Hold regular progress report meetings with students	Master's	4.56	4.48	4.48	4.22	4.43	4.38	4.26	4.29	712	4.37
	Doctoral	4.49	4.42	4.56	4.28	4.39	4.33	4.15	4.31	663	4.34
9. Set deadlines for submission of particular parts of thesis	Master's	3.78	3.85	4.10	3.38	3.83	3.65	3.92	3.91	704	3.78
	Doctoral	3.67	3.79	4.06	3.24	3.73	3.47	3.77	3.76	656	3.65
10. Provide prompt feedback on draft chapters of thesis	Master's	4.51	4.40	4.71	4.31	4.40	4.54	4.46	4.56	711	4.47
	Doctoral	4.55	4.34	4.75	4.32	4.39	4.56	4.42	4.59	664	4.47
11. Provide assistance in orienting students towards appropriate behavior in oral examinations	Master's	4.03	3.78	3.90	3.56	3.96	4.02	3.68	4.01	663	3.88
	Doctoral	4.03	3.69	3.88	3.62	3.92	4.12	3.53	3.99	660	3.85

Note: The response categories were 1=None; 2=A little; 3=Some; 4=Considerable; and 5=Great; (9=Not applicable or No opinion).

because they provided insights into supervision from faculty members assessed as "experienced supervisors." Some quotations represent conflicting viewpoints whereas others are complementary. They do not necessarily represent widely shared opinions, although some were typical of the views of many respondents. The means for each discipline area and the total means for all responses are shown in Tables 2, 3, 4, and 5. Because its size was very small the Interdisciplinary group was not included.

The questions in the supervisors' questionnaire were sorted into groups of questions in the tables on these bases: (a) Table 2 contains general questions about supervisory relationships (input, process, and output variables in Figure 1); and (b) Tables 3, 4, and 5 contain questions relating to the importance of aspects of supervision — at the university, unit, and supervisor level respectively — in assisting thesis students to complete their theses and pass oral examinations in an appropriate period of time (input and process variables in Figure 1).

The detailed results in the tables are usually not repeated in the text of this article; the emphasis is on producing generalizations about various aspects of supervision and on identifying similarities and differences between disciplines.

Research Relationships

Supervisors were asked to indicate how frequently students' thesis research projects were an integral part of or closely related to their supervisor's research activities. The overall means for master's and doctoral programs were 3.65 and 3.86, which occur between "Often" (3) and "Usually" (4). Biology, Engineering, Physical Sciences, and Health had substantially higher master's-level means (4.03-4.25) for this relationship than did the Humanities, Education, and Social Sciences (2.96-3.23). For doctoral students, the same discipline groupings were obtained with the four highest means being 4.19-4.33 and the lowest three 3.25-3.42.

The following quotations indicate the types of issues that emerge in the relationship between students' and supervisors' research in specific disciplines:

> *It seems clear that different constraints operate in the humanities vs. sciences owing to financial requirements of sciences. Students in science must work on projects of their supervisor's origin with relatively limited room for digression, relative to what is possible in other disciplines.* (Agriculture/Biology)
>
> *In the humanities — where individual research is the norm — advisors must be scrupulous about the relations between theirs and their students' research. If a student is working in exactly the same area, the responsibility is the advisor's not to overlap.* (Humanities)
>
> *I think that students at the master's and doctoral levels would profit from being invited to be more closely associated with the scientific activities of their department and participating in those activities. It would be good for*

> *them not to feel too isolated in their research. It would be good to create ways of integrating these students so that they have the feeling of being at a level that is truly different than that of undergraduate students.* (Law)
>
> *Key to success — match student interests with those of a potential supervisor before accepting student.* (Physical Sciences)

Maximum Supervisory Load

Just over half (54%) of the respondents considered that the maximum number of graduate students on thesis programs that one faculty member can supervise should be restricted. The highest level of agreement occurred for Business respondents (75%) and the lowest in Engineering (32%) and Biology (39%). Those who favored a restriction identified the maximum number. The overall mean maximum number was 5.18, with the highest maximum being obtained for Education (5.71), Physical Sciences (5.60), and Humanities (5.57), and the lowest for Health (4.36).

Of course, the maximum number of graduate students who can be supervised effectively by any one faculty member depends upon other aspects of workload such as undergraduate and graduate teaching, administration, service, research, and involvement with postdoctoral fellows. The supervisory workload also depends upon the stages that master's/doctoral students are at with respect to their thesis research as well as aspects such as complexity of the research and the students' competence and diligence.

> *Graduate supervision, like undergraduate teaching, should be assigned teaching credit. Therefore the number of graduate students assigned to individual faculty must be determined by program and overall teaching needs.* (Area not identified)
>
> *The work load of "active" professors seems to get heavier and heavier. It would be extremely important to treat student supervision as seriously as group teaching, thus a sort of quantification is necessary.* (Humanities)
>
> *Depends on the ability of the supervisor; supervisors are not clones! Some have a problem with one student, whereas others are able to handle 5-6 with no problems.* (Medicine)

Assistance Provided to Students

Table 2 presents the distribution of supervisors' responses about the extent to which supervisors, or faculty members in the case of Question 1, should assist graduate students in certain functions. Questions 1 to 4 are related to thesis tasks. The highest level of support was obtained for faculty members assisting in development of thesis research proposals (master's level mean 4.23; doctoral 4.00). Assistance with refining and improving theses before the final oral examination was only slightly less supported (4.06; 3.82), while assistance with data analysis (3.33 and 2.92) and collection of data (2.70 and 2.41) were both substantially less supported. In all four functions, greater support for master's students was indicated than for doctoral students.

Questions 5 to 8 in Table 2 are related to assistance with non-thesis functions for doctoral students. The supervisors' responses showed "Some" to "Substantial" support for assistance in preparation of journal manuscripts (mean = 3.83), preparation of conference paper proposals (3.69), development of teaching skills (3.58), and development of skills in preparing research grant applications (3.48). These results show that the Canadian supervisors in this study placed considerable importance upon development of skills and preparation of academic papers and proposals, in addition to providing help with aspects of thesis research and thesis production.

> *Supervisors should also encourage students to attend conferences, make presentations, and otherwise expose students to discuss their work with visitors working in the area.* (Physical Sciences)
>
> *Any presentation, written or oral, is a reflection of the lab in which the student is working. Graduate training should be teamwork between the supervisor and graduate student.* (Medicine)

Importance of Supervisory Aspects

Data about the supervisors' responses concerning the importance of aspects of supervision—at the university, unit, and supervisor levels — for completing theses and passing final examinations in an appropriate period of time are shown in Tables 3, 4, and 5.

For master's programs, the highest importance was placed on providing prompt feedback on draft chapters (mean = 4.47), ensuring that the thesis project does not grow excessively (4.39), helping to revise research design if unforeseen problems require this (4.37), holding regular progress report meetings (4.37), ensuring continual progress (4.21), providing a graduate student handbook (4.15), providing balance between direction and independence (4.11), and assigning supervisors who are expert in the student's specific research fields (4.06). All these means were above "Considerable" (4) on the response scale. For doctoral programs the results were similar except that the doctoral means were somewhat higher for these functions: (a) for providing balance between direction and independence (4.35 vs. 4.11); (b) for assigning supervisors who are expert in the students' specific research fields (4.30 vs. 4.06); and (c) providing settings in which students can present progress reports (4.16 vs. 3.90).

> *Our program requires submission of a progress report by the supervisor for each student every semester, with a copy going to the student.* (Physical Sciences)
>
> *Progress reports have been implemented in our unit and we hope to improve the flow and timely completion especially at the master's level.* (Fine Arts)
>
> *The matching of supervisors/students should not be done unilaterally by the unit. This should be achieved by mutual agreement between students and available potential supervisors.* (Physical Sciences)

Characteristics of Disciplinary Groups

Categorization of the supervisors' responses allowed syntheses of the characteristics of discipline groups to be developed. Because these supervisors were experienced and were located in universities across Canada these syntheses should be viewed as reasonably representative of the disciplines. However, they must also be seen as generalizations which do not necessarily apply to all supervisors and which warrant further research. In order to simplify the presentation only the responses for doctoral programs have been used in this section.

Similarities. Initially, those aspects of supervision for which the means were similar must be identified. The nine aspects for which the range of discipline means for doctoral programs was less than 0.50 and which had an approximately even distribution across the range are listed below, sometimes in paraphrased form. Several relevant quotations are included.

1. "Assist in analyses of data for theses": the means were all approximately "Some," with the range being 2.67 (Social Sciences) to 3.09 (Health).

> *Becoming a scholar is a collaborative apprenticeship; we supervisors share with students the process of doing research, writing it up, presenting it, submitting it, applying for grants. The writing, particularly, is always a collaborative enterprise — which means frequent feedback — and even help with revision/editing may be required.* (Education)

2. "Assist doctoral students in development of teaching skills": the means were in the "Some" to "Substantial" range, varying from 3.39 (Engineering) to 3.82 (Humanities).
3. "Assign supervisors who are expert in the students' specific research fields": the means were all above 4.00 ("Considerable"), ranging from 4.11 (Social Sciences) to 4.45 (Biology).

> *The fact that certain professors who engage in no research activity are authorized to direct master's and doctoral students seems to me to be nonsense. This situation, along with the lack of relationship between the thesis subjects and the areas of interest of the directors, explains a large part of the problems related to abandonment or the excessive length of studies at the doctoral level.* (Business/Commerce)

4. "Provide a graduate student handbook. . . ." had a range from 4.00 (Engineering) to 4.28 (Humanities).
5. "Provide balance between direction and independence": the doctoral means for each discipline were generally somewhat above "Considerable," varying from 4.16 (Engineering) to 4.46 (Biology).

> *It's most important to provide a balance between supervisor's direction and student's independence. It is not up to the supervisor to provide the incentive for the student to finish a project, but it is up to the supervisor to set*

> *reasonable deadlines and return work promptly with appropriate recommendations.* (Humanities)
>
> *An issue that supervisors are continually faced with is the balance between giving direction and guidance versus allowing the free progress of students. While it is desirable that students are as independent as possible, the demands of granting councils require high productivity.* (Medicine)
>
> *Student-advisor relationships are very subtle. Know when to push, when to back off. Help without too much dependence. Supervision is about individuals and their growth.* (Education)

6. "Ensure that students continually make progress": the doctoral means were about or somewhat above "Considerable," ranging from 3.97 (Social Sciences) to 4.38 (Biology).
7. "Help students revise research design if unforeseen problems occur:" the doctoral means were generally higher than "Considerable," ranging from 4.00 (Social Sciences) to 4.49 (Biology).
8. "Hold regular progress meetings": the doctoral means were in the "Considerable" to "Great" range, varying from 4.15 (Social Sciences) to 4.56 (Business).

> *Graduate training is an apprenticeship program. The one-on-one relationship between student and supervisor is the strength of graduate education. A committee structure should function as a back-up to prevent breakdown of relations on either side.* (Agriculture/Biology)

9. "Provide prompt feedback on draft chapters" had the highest doctoral mean (4.47), almost halfway between "Considerable" and "Great." The range was 4.32 (Physical Sciences) to 4.75 (Business).

Differences. In the following section other supervisory aspects whose means for a disciplinary area for doctoral programs were either 0.30 above or 0.30 below the overall mean for the aspect are identified. (See Table 6.) That is, the entry of either H (higher) or L (lower) in Table 6 indicates that the discipline mean varied substantially from the mean for the aspect and not that the mean itself was high or low. The profiles for the eight discipline areas were dissimilar. Some information about means for Biology at the master's level is also included.

Biology had substantially higher doctoral means on five aspects: assisting in preparing journal manuscripts, assigning supervisors at the beginning of the program, involving other faculty members in students' research, providing settings for progress reports, and motivating continually.

> *Our students are associated with particular supervisors as part of the acceptance process. Switching is rare.* (Agriculture/Biology)

Health also had only substantially higher doctoral means, but for three aspects which generally indicate a stronger focus on developing scholarship: assisting with development of skills in preparing research grant applications, conference paper proposals, and journal manuscripts.

Table 6

Aspects of Supervision in Which the Means of Supervisors' Responses in a Doctoral Discipline Area Were Either Substantially Higher or Substantially Lower Than the Overall Response Means

ASPECT OF SUPERVISION	BIOL	ENG	BUS	PHYSSCI	HEALTH	ED	SOCSCI	HUM	MEAN
1. Thesis proposal development			L						4.00
2. Collection of data				H		L			2.41
4. Refine and improve theses		L	H						3.82
6. Research grant applications		L		L	H				3.48
7. Conference paper proposals					H		L		3.69
8. Journal manuscripts	H			H	H		L	L	3.83
1. Assign supervisors early	H		L					L	4.00
3. Match personalities			H						2.95
5. Involve other faculty	H	L							3.64
6. Present progress reports	H				H				4.16
3. Motivate continually	H					L	L		3.45
4. Provide personal counselling			H				L		3.12
5. Comfortable methodologies				L		H		H	3.23
6. Not grow excessively								H	4.26
9. Set deadlines			H	L					3.65
10. Orient to oral examination							L		3.85

Note: "Substantially" meant a difference of at least 0.30 from the overall mean: H=higher; L=lower.

Three substantially lower doctoral means were obtained for Engineering: assisting with refining and improving theses, assisting with development of skills in preparing research grant applications, and involving other faculty members in students' research.

The biggest problem lies with ill-defined research topics. (Engineering)

Social Sciences also had only lower doctoral means with the five being related to conference paper proposals, journal manuscripts, motivating continually, personal counselling, and orienting to the final oral examination.

The four other disciplinary areas had mixtures of higher and lower doctoral means. Humanities had substantially lower means for assisting with journal manuscripts and assigning supervisors early but substantially higher means for both encouraging use of methodologies with which students are comfortable and ensuring that the thesis project does not grow excessively. Education also had higher emphasis on comfort with methodologies, together with lower emphasis on assisting in data collection and motivating continually. More variability was shown by Business which had four substantially higher means — refining and improving theses, matching personalities, providing personal counselling, and setting deadlines — and two substantially lower means — assisting in developing thesis proposals, and assigning supervisors early. Physical Sciences also showed considerable variability with substantially higher means for assisting in data collection and with journal manuscripts and substantially lower means for assisting in developing skills for research grant applications, emphasis on comfort with methodologies, and setting deadlines.

Commonalities. Some commonalties are also of interest. Biology, Physical Sciences, and Health all had substantially higher means on assisting with preparing journal manuscripts which seems to reflect their well-known emphasis on encouraging publication by graduate students. Also, several respondents from different disciplines provided these comments about assignment of supervisors:

> *Should consider historic success rate of supervisors when assigning students to them.* (Engineering)
>
> *PhD supervision should be outlined in detail in a policy paper that has the status of a contract between the university, department, and supervisor on the one-hand and the student on the other. Supervisors should be negotiated, not assigned.* (Humanities)
>
> *Entirely too little attention is paid to student personality as a crucial variable in success or failure in graduate programs.* (Mathematics/Statistics)
>
> *Essential to assign supervisors at start of program.* (Physical Sciences)
>
> *One of the big problems today in Canadian universities is promotion of the myth of equality. Not all faculty are equally prepared to assist students with an MA or PhD level thesis or dissertation. Some people teach at the graduate level because they have been around longer and their feelings would be hurt if they did not.* (Social Work)

Also, both Education and Social Sciences had substantially lower means for motivating continually which may seem to be inconsistent with the general perception of attitudes in these disciplinary areas. The variation in discipline means at the master's level was often similar to that observed at the doctoral level. However, the master's level means for Biology were higher than the overall mean and the means for most of the other disciplines by at least 0.3 for these supervisory aspects: assign supervisors who are expert in the student's specific research fields; involve other faculty members; provide settings for progress reports; and motivate continually.

Other Matters

Several other matters were addressed by respondents in their comments. These especially related to (a) funding of students, (b) completion, and (c) recognition of the value of supervision. The first set of quotations involve the funding of graduate students which was not included in the supervisors' questionnaire because it was a major component of the graduate coordinators' questionnaire.

> *Students need to be made aware of the total amount of funding that will be available during their study: guarantee of funds minimizes many difficulties which will be encountered.* (Physical Sciences)
>
> *One of the greatest influences upon success is funding.* (English)
>
> *The question of financing graduate studies, which is not treated in this questionnaire, is, in my opinion, the major problem for which remedies must be found in order for Canada to get out of its growing under-development.* (Agriculture/Biology)
>
> *The major impediment to normal progress on thesis or dissertation has been inadequate financial support which has required students to seek employment in order to meet basic expenses.* (Social Sciences)

Respondents also provided comments relevant to time to complete graduate programs. The following are typical:

> *There is some danger that we are now over-emphasizing the time-to-completion aspect. We also need reflection time, proper time for research, and a thoughtful approach.* (Social Sciences)
>
> *Theses that take years to complete are usually the last pieces of substantial research that these students undertake, instead of being, as they should be, the first. The statistics on my own students convince me that the faster they have completed their doctoral programs, the more productive and original scholars they are likely to be. Parkinson's Law is otherwise in full operation.* (Humanities)
>
> *I am strongly of the opinion that, in the humanities at least, the doctoral program — courses, comprehensives, and thesis — should be treated as a single overall process, rather than sequential, as often happens now. Thesis topic should be isolated and developed with the supervisor at the beginning of the program, and work in courses and preparation for comprehensives should be regarded as a whole, with frequent crossovers. If this is done, many more students than at the present could complete the PhD within reach of the statutory minimum of two years after the M.A. steadily and without undue strain.* (Humanities)

Other quotations were added relevant to recognition of the value of supervision of graduate students:

> *Grad supervision is a very undervalued contribution in university circles, both with regard to work and rewards.* (Agriculture/Biology)
>
> *A great deal of supervision would be better administered if the very activity of supervision of master's and doctoral students were better recognized and valued by the universities.* (Library Science)

> *Professors who supervise theses should be given credit as it is a long, difficult process for the student and the supervisor.* (Education)
>
> *The excellence of graduate students in the biomedical sciences is exclusively a consequence of the supervisor, not to any great extent the student (assuming a reasonably good level of overall student competence i.e., intelligence, work habits, mental discipline).* (Medicine)

Generalizations

Considerable support was evident for restricting graduate supervision to faculty members active in research and publication, for assigning supervisors who are expert in the students' specific research fields, for having students conduct research closely related to their supervisor's research, and for assigning supervisors at the beginning of students' programs. Involvement of students in the selection of supervisors was favored by several respondents in their written comments. While recognizing that many variables affect the number of thesis-route graduate students that one faculty member can supervise effectively, those who favored a restriction on the maximum number tended to select five as the maximum.

In general, respondents considered that "Substantial" assistance should be provided to graduate students in development of thesis proposals and in refinement and improvement of theses. Less support was obtained for collection and analysis of data but responses for these two functions varied substantially across discipline areas. More assistance was advocated for master's students than for doctoral students.

Between "Some" and "Substantial" support was evident for assistance to doctoral students in (a) development of teaching skills and research grant applications and (b) preparation of conference paper proposals and journal manuscripts.

The 10 practices which were perceived to be the most important in assisting students to successfully complete their theses in an appropriate time and pass the final oral examination were as follows: provide prompt feedback; provide balance between supervisor's direction and student's independence; hold regular progress report meetings; assign supervisors who are expert in the students' specific research fields; help students revise research design if unforeseen problems require such revision; ensure that the thesis project does not grow excessively; ensure that students continually make progress; provide settings for students to present progress reports for feedback; provide a detailed student handbook; and assign supervisors at the beginning of student' programs.

Several of these practices have commonly been identified as important in the literature (e.g., the holding of regular meetings — Moses, 1992; Powles, 1993), whereas others were identified in interviews conducted earlier in this study (e.g. help students revise research design if unforeseen problems require such revision).

When the supervisors' responses were categorized by discipline area for doctoral programs, several aspects of supervision were viewed as important across all disciplines, e.g., ensure that students continually make progress, provide prompt feedback on draft chapters, and hold regular progress report meetings with students. Other aspects showed substantial differences across disciplines, for example, assisting with preparation of manuscripts for submission to refereed journals was strongly supported by supervisors in Biology, Physical Sciences, and Health but far less strongly by supervisors in Social Sciences and Humanities. Different levels of support for aspects of supervision were noted for each discipline, for example, Biology and Health each were substantially higher in their level of support for five and three supervisory aspects respectively, while Social Sciences was substantially lower for five supervisory aspects. The Biology responses showed the greatest overall level of support for many of the supervisory aspects listed on the questionnaire at both the master's and doctoral levels.

Concluding Comments

Many publications (e.g., Moses, 1992; Smith 1991) have emphasized the importance of effective practices in the supervision of graduate students. "Importance" and "effectiveness" relate to many aspects of the graduate experience, including the development of skills, knowledge, and attitudes (e.g., Blume, 1987); the research output (e.g., Gumport, 1993); satisfaction and status of supervisors (e.g., Moses, 1992; Powles, 1993); and benefits to students, supervisors, departments, and universities (e.g., Bowen & Rudenstine, 1992).

The research literature on graduate supervision, however, is not extensive. Hopefully, this project has helped to overcome this defect by providing information from a large number of expert supervisors in many disciplines and universities across Canada about aspects of the supervision process. Its findings generally support the propositions identified in the literature overview but they point out that emphases on most supervisory practices differ across disciplines. Also, positions held by individual supervisors within a discipline tend to be highly variable, so the nature of graduate supervision is quite idiosyncratic.

Some of the matters discussed in this paper had not been raised in detail in the graduate studies literature. For example, little attention has been paid to the assistance given by supervisors to the activities of students shown in Figure 1 which are usually not directly related to preparation of the thesis, for example, development of skills in preparation of research grant applications, conference paper proposals, and journal manuscripts. Other supervisory aspects which were explored in this study and which are either ignored in the literature or dealt with only briefly are provision of personal counselling, encouraging students to use methodologies with which they are comfortable, and helping students to revise the research design if unforeseen problems require such revisions. Further research on such aspects should be conducted.

Comments provided by individual supervisors also yielded important insights which were not the subject of specific questions, as shown by this quotation:

> *Other important tasks of supervisors: advise students when to stop research and prepare final document; advise how much reading/experimentation/analysis will normally be expected.* (English)

The framework in Figure 1 emphasizes inputs and outputs relevant to both the supervisory process and the activities of graduate students. With respect to inputs, the results of this study reinforced the influence of the culture of the discipline, characteristics of the supervisor, and elements of the infrastructure upon the supervisory process. The aspects of supervision shown in Figure 1 were also identified as important in this study, together with the supervisor's involvement with activities of the student, although both of these varied by discipline. Outputs were not specifically addressed as such in this study although they are directly related to student activities.

Administrators and graduate supervisors should pay attention to the list of the most important practices identified by respondents in this study while simultaneously recognizing that some differences exist between disciplines, between supervisors, and between master's and doctoral programs. The approaches taken are contingent on many factors, as Burgess *et al.* (1994) described. Despite these differences, some Canadian universities may consider following the proposed procedure at The University of Melbourne that all new staff members who want to supervise graduate students will be required to attend orientation seminars on effective supervisory practices. These seminars should address the issues raised in this and other studies. Such an approach should at least ensure that new supervisors are aware of the relevant issues and that they reflect upon the type of supervisory style that they will use. Consequently, over time, effectiveness of graduate supervision could be improved, the overall quality of the graduate experience could be enhanced, and some of the barriers to graduate program completion could be overcome.

References

Association of Universities and Colleges of Canada. (1992). *Report of the AUCC Task Force on the Report of the Commission of Inquiry on Canadian University Education.* Ottawa, ON: Author.

Ballard, B., & Clanchy, J. (1993). Supervising students from overseas. In D. J. Cullen (Ed.), *Quality in PhD education* (pp. 61-73). Canberra: Australian National University.

Blume, S. (1987). A European perspective. *Economic and Social Research Newsletter (U.K.) 60*, June, 14-15.

Bowen, W. G., & Rudenstine, N. L. (1992). *In pursuit of the PhD.* Princeton, NJ: Princeton University Press.

Burgess, R. G., Pole, C. J., & Hockey, J. (1994). Strategies for managing and supervising the social sciences PhD. In R. G. Burgess (Ed.), *Postgraduate education and training in the social sciences: Processes and products* (pp. 13-33). London: Jessica Kingsley.

Canadian Association for Graduate Studies. (1992). *Statistical Report.* Ottawa, ON: Author.

Christopherson, D., Boyd, R. L. F., Fleming, I., Macdonald, I. G., Mylroi, M. G., Wardlaw, A. C., & Willmott, J. C. (1992). *Research student and supervisors: An approach to good supervisory practice.* Swindon, UK: Science and Engineering Research Council.

Conrad, C. F., Haworth, J. G., & Millar, S. B. (1993). *A silent success: Master's education in the United States*. Baltimore, MD: The John Hopkins University Press.

Council of Graduate Schools. (1990). *Research student and supervisor.* Washington, DC: Author.

Donald, J. G., Saroyan, A., & Denison, D. B. (1994, June). *Graduate student supervision policies and procedures: A case study of issues and factors affecting graduate study.* Paper presented at the annual meeting of the Canadian Society for the Study of Higher Education, Calgary, AB.

Gumport, P. J. (1993). Graduate education and organized research in the United States. In B. R. Clark (Ed.), *The research foundations of graduate education: Germany, Britain, France, United States, Japan* (pp. 225-260). Berkeley, CA: University of California Press.

Hill, T., Acker, S., & Black, E. (1994). Research students and their supervisors in education and psychology. In R. G. Burgess (Ed.), *Postgraduate education and training in the social sciences: Processes and products* (pp. 53-72). London: Jessica Kingsley.

Holdaway, E. A., Deblois, C., & Winchester, I. S. (1994). Practices and opinions reported by coordinators of graduate programs. *Interchange, 25*(1), 65-86.

Moses, I. (1985). *Supervising postgraduates.* Sydney, Australia: Higher Education Research and Development Society of Australasia, c/o University of New South Wales.

Moses, I. (1992). Good supervisory practice. In I. Moses (Ed.), *Research training and supervision* (pp. 11-15). Proceedings of a conference sponsored by the Australian Vice-Chancellors' Committee and the Australian National Board of Employment, Education and Training. Canberra: Australian Research Council.

Phillips, E. M., & Pugh, D. S. (1987). *How to get a PhD.* Milton Keynes, UK: Open University Press.

Powles, M. (1989). *How's your thesis going?* Melbourne, Australia: Centre for the Study of Higher Education, University of Melbourne.

Powles, M. (1993). Staff development for PhD supervision. In D. J. Cullen (Ed.), *Quality in PhD education* (pp. 75-84). Canberra: Australian National University.

Royal Society of Canada. (1991). *Realizing the potential: A strategy for university research in Canada.* Ottawa, ON: Author.

Salmon, P. (1992). *Achieving a PhD—ten students' experience.* Oakhill, Stoke-on-Trent, England: Trentham Books.

Smith, S. L. (1991). *Report: Commission of Inquiry on Canadian University Education.* Ottawa, ON: Association of Universities and Colleges of Canada.

Predictors of Time to Completion of Graduate Degrees

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Abstract

A multiple regression procedure was utilized to predict the time taken to complete graduate degree requirements for 395 master's and 79 doctoral students at a large Canadian university. Selected demographic (e.g., sex, age, marital status, registration status, citizenship), academic (e.g., undergraduate and graduate GPA, discipline, type of program) and financial support variables (funding received from internal and external scholarships and from research, graduate and teaching assistantships) were used as independent variables. Results for master's students indicate that full-time registration, increased financial support, higher graduate GPA and enrolment in a humanities discipline significantly decrease time to completion. Conversely, a thesis requirement and Canadian citizenship are associated with significantly slower degree progress. For doctoral students, enrolment in a natural sciences discipline, Canadian citizenship, full-time registration and increased funding significantly decrease the time taken to complete the doctorate.

Résumé

Afin de prédire le temps requis pour satisfaire aux exigences des études supérieures, nous avons utilisé une méthode de régression multiple pour évaluer 395 étudiant(e)s de maîtrise ainsi que 79 étudiant(e)s de doctorat d'une grande université canadienne. Les critères démographiques suivants (le sexe, l'âge, le statut social, le type d'inscription et la citoyenneté), ainsi que le genre d'aide financière que les étudiant(e)s reçoivent (bourses internes et externes, bourses de recherche, charges de recherche ou d'enseignement) ont été utilisés comme variables indépendantes. En ce qui concerne les étudiant(e)s de maîtrise, les résultats démontrent qu'une inscription à plein temps, une aide financière accrue, un GPA plus élevé et l'étude des sciences humaines réduisent considérablement le temps requis pour compléter la maîtrise. Inversement, les exigences d'une thèse et la citoyenneté canadienne sont associées à des progrès beaucoup plus lents. En ce qui concerne les étudiant(e)s de doctorat, l'étude des sciences humaines, la citoyenneté canadienne, une inscription à plein temps ainsi qu'une aide financière élevée réduisent le temps requis pour compléter le doctorat.

Introduction

Unlike the study of graduate student attrition (Pyke & Sheridan, 1993), the length of time taken to complete graduate degrees has been the focus of considerable attention for several decades (Abedi & Benkin, 1987; Baird, 1990; Berelson, 1960; Bowen & Rudenstine, 1992; Carmichael, 1961; Filteau, 1992; Harmon, 1978). Despite widespread interest in the topic and publication and interpretation of some large scale data sets (National Research Council, 1989), the desirability of more systematic data collection and dissemination with respect to graduate student progress within individual institutions has been recognized (Cude, 1991; Yeates, 1991). Additionally, there is a need for more elaborate forms of statistical analysis to enable assessments of the differential contribution of various key factors affecting the time taken to complete graduate programs. Furthermore, most of the literature on the completion time variable confounds master's and doctoral level training. The common statistic used is the total time to the doctorate (TTD) which refers to the time between receipt of the baccalaureate and receipt of the doctorate, including any time spent out of university after obtaining the undergraduate degree and prior to entry into graduate school. Finally, more information on the situation in Canadian doctoral programs would be useful. The present study is designed to address these issues.

Reports on the average or median time taken to complete graduate degrees vary as a function of the year the data were collected. In general, earlier studies report shorter completion times. For example, based on the National Research Council survey (1989), Evangelauf (1989) comments that "the typical new doctoral recipient spent a median 6.9 years in graduate school, up from 6.1 years in 1977. Over the same period, the total median time that elapsed between the earning of a bachelor's degree and a doctorate rose to 10.4 years from 8.7 years" (p. A13). However, the magnitude of the increase may be artifactually expanded as a consequence of grouping students by year of graduation rather than year of entry into graduate school (Bowen & Rudenstine, 1992).

As noted above, the operational definition of the dependent variable will obviously affect the time to completion statistic; largest values result from use of the TTD index. Using the registered time to the doctorate (RTD), which excludes time prior to entry into graduate school as well as time not enrolled at the university (e.g., time spent on leave), Tuckman, Coyle, and Bae (1989) report an average RTD of 5.63 years in 1967 as compared with 7.02 years in 1986. Comparable figures for the average TTD are 8.19 years and 9.84 years respectively. A more precise measure of time to completion (time elapsed from admission into a doctoral program and graduation) was utilized in a study of the 1980 cohort of doctoral students admitted to doctoral programs in Ontario universities (Yeates, 1991). The median time to completion was five years.

Among the most consistent findings in the literature is the relationship between field of study and time to completion. Duggan (1989) reported that the average length of time taken to complete doctoral degrees at the University of California at Berkeley between 1980 and 1987 was 6.9 years; however, considerable variability across disciplines was observed. Students in languages and literary studies, in the arts, and in the social sciences took over eight years on average to complete their degrees (8.9, 8.6 and 8.4 years respectively), while students in engineering and in the physical and biological sciences took six years or less on average to complete their program requirements (5.5 years, 6.0 years and 6.2 years respectively). These findings are more or less typical. Yeates (1991) for example, reports that the fastest time to completion (approximately 4.5 years) occurred with science students. Students in professional programs occupied an intermediate position while students in social science and humanities disciplines achieved a median completion time of 5.6 years. Fletcher and Stren (1992) conducted a survey of recent graduates of the University of Toronto and similarly reported that students in the humanities, social sciences, education and law take significantly longer on average to complete their doctoral programs than do students in the physical, biological and life sciences and engineering.

Another variable explored by several investigators is the relationship between the financial support package available to the student and the time taken to complete the degree. In a study of over 4000 doctoral degree recipients at the University of California at Los Angeles, Abedi and Benkin (1987) found that students relying on their own earnings as their primary source of income required, on average, two years longer to complete their doctoral training than those students whose income derived from other sources. With respect to the latter, students awarded grants and fellowships took longer to complete their doctorates than did those supported through research or teaching assistantships. These authors speculate that the net effect of funding via grants and fellowships is an increased amount of time spent pursuing non-degree-related activities. Nonconvergent results were reported by Tuckman, Coyle and Bae (1990), who found that fellowship funding contributed to shorter completion times, while personal financing, research or teaching assistantships increased TTD. Bowen and Rudenstine (1992) also observe that students forced to rely on their own financial resources have longer times to completion than students who receive financial aid and note further that the source or form of funding is much less relevant. However, their findings vis-à-vis fellowships versus teaching assistantships are consistent with those of Tuckman et al. (1990). Fletcher and Stren (1992) conclude that the "impediments to a speedy completion of the Ph.D. at the University of Toronto are primarily financial" (p. 38) and are concentrated in humanities and social science disciplines, thus accounting for the longer time to completion in these fields.

Gender differences in time to completion is another popular variable of study. Most investigators discovering such differences find that female students take longer to complete their degree requirements than do males (Tuckman *et al.*, 1990), although some researchers report that gender differences only appear in certain fields or the position of each sex may be reversed, depending on the discipline in question (Bowen & Rudenstine, 1992; MacMillan, 1989). It has been suggested that gender differences reflect the concentration of the sexes in certain disciplines (i.e., that women are concentrated in disciplines with long completion times, such as the humanities) or that they reflect gender-based differences in levels and type of financial support, or various other factors (Berg & Ferber, 1983). However, Sheinin (1989) notes that, with the exception of the life sciences and education, completion times for doctoral degrees at the University of Toronto are almost universally longer for women than for men (6.1 years for women and 5.6 years for men). Yeates (1991) also reports that male students in the 1980 doctoral cohort in Ontario had a faster median time to completion than female students (4.7 years versus 5.3 years). However, many studies (e.g., those of Sheinin and Yeates) fail to subject these results to statistical analysis; and, hence, it is difficult to determine whether differences of the magnitude observed are significant.

Various other variables examined in terms of their relationship to TTD include citizenship, marital status, number of dependents, age, unemployment rates, number of full-time faculty and level of federal research and development support received by the university. With respect to the citizenship factor, Yeates (1991) reports that foreign students completed their doctoral degrees more quickly; the median time to completion for foreign students was four years as compared with five years for domestic students. Decreased time to the doctorate was found to be associated with married status and having dependents while longer TTD was found in conjunction with being older at entry to graduate school, more full-time faculty, more research and development support and higher unemployment rates (Tuckman *et al.*, 1990).

There are relatively few available studies dealing with the length of time to degree completion at the master's level. McLennan (cited in Marr & McPherson, 1992) reported an average length of 35 months to the master's degree in a large cohort of graduate students at the University of Saskatchewan. He found differences in length of time to degree by area of study, with students in the humanities and fine arts requiring 41 months on average, followed by students in the physical and engineering sciences (36 months), students in the social sciences (35 months) and students in the life sciences (33 months). McLennan found no effect of undergraduate grades, gender of student, or scholarship awards on length of time to degree completion. He did find that Canadian students required longer to complete their master's degrees than did foreign students and that the thesis option required more time in the life and social sciences than did the coursework-only option.

Marr and McPherson (1992) provided descriptive information for 1985 and 1987 on 29 master's programs in five Ontario universities which do not offer doctoral training. These authors found a median time to completion of seven terms (28 months), with a range of six to ten terms (24 to 40 months). Longer times to degree completion were observed in the physical and biological sciences. Longer mean times to completion were also reported for programs with thesis requirements as opposed to major research projects in combination with coursework or coursework alone.

Sheinin (1989) notes that the average time to completion of master's degrees at the University of Toronto was 2.1 years with women completing slightly more quickly (2.0 years) than men (2.4 years). As has been reported with respect to completion time in doctoral programs, some area of study differences were observed, with longer times to completion in education (2.9 years) and the life sciences (2.4 years) and shorter times in the humanities (1.8 years) and social science (1.9 years) disciplines.

This brief review of the current literature on length of time to graduate degree completion reveals a number of important limitations. Most investigations have focused on doctoral candidates, while much less attention has been paid to length of time taken to complete master's degrees (Marr & McPherson, 1992; Sheinin, 1989; Sheridan, 1992). A number of studies provide descriptive and qualitative information regarding the scope of the problem, but do not provide information on associated or causal factors of increased time to the degree. Many authors fail to take into account such potentially significant variables as gender of student and availability and distribution of financial support. Nor do most researchers attempt to determine the relative importance of the various relevant variables. The present investigation was designed to identify the differential contribution of a number of demographic, academic and financial factors on the time taken to complete master's as well as doctoral degrees.

Method

Subjects

From a simple random selection procedure, a group of 698 graduate students admitted to various disciplines at York University, between January 1, 1975 and December 31, 1985, was identified. A total of 474 of these students successfully completed all program requirements (395 master's and 79 doctoral students) and this subset constitutes the sample for the study. The small number of graduated doctoral students selected via this procedure reflects the smaller number of doctoral admissions, the higher dropout rate for doctoral students and the fact that some Ph.D. students fail to complete within a ten year time frame. As all disciplines have either one- or two-year master's (M.A. and M.Sc.) degree programs, the selection of this ten-year cohort permitted assessment of length of time to degree completion across a series of master's classes. In addition, it was expected that the ten-year period of the investigation would allow sufficient time for almost all doctoral (Ph.D.) candidates beginning in January, 1975 to have either withdrawn or to have convocated by December, 1985.

Students from graduate programs in three discipline areas, natural sciences, social sciences and humanities, were included in this investigation. Natural science disciplines consisted of biology, chemistry, mathematics, and physics; social science disciplines encompassed economics, exercise and sports science, geography, political science, psychology, social and political thought, social anthropology, and sociology; and humanities disciplines included art history, English, history, and philosophy.

Variables

The selection of variables was determined primarily by the level of support they had received in the literature (Sheridan, 1990). A secondary consideration was that the variables be available in relatively standardized form to ensure reliable retrieval from the archival record system. Twenty variables were selected for investigation as follows.

Demographic variables. These included the gender of the student, the registration status (full- or part-time) and marital status of the student at the point of entrance into the graduate program, the student's age, the square of the student's age, and citizenship status. Since graduate students frequently move from full- to part-time status once residency requirements are met, determination of status was based on the student's initial registration as either a full- or part-time student. The age-squared variable was selected on the basis of a rationale which would allow for the possibility that the relationship between age and degree progress might be nonlinear in the sense that both younger and older students might have longer completion times than those in a middle age range. The quadratic term was therefore made available to the regression equation in case an adequate accounting for age should require it. Citizenship status comprised three levels: Canadian, landed immigrant, or foreign citizen.

Academic variables. These included the undergraduate and graduate grade point averages (GPAs) of the student, the student's discipline area, the type of program chosen, and whether the student had ever taken a leave of absence (LOA).

Undergraduate GPA was calculated as the average of the student's grades in the final two years of undergraduate study; the graduate GPA of the student was calculated as the weighted (half- or full-course equivalents) average of the student's grades in the master's or doctoral years.

The student's discipline area was classified as natural sciences, social sciences, or humanities. The type of program variable was applicable to master's students only because the type of program for students at the doctoral level is uniform across discipline areas (i.e., coursework plus a dissertation). Type of program for master's students was dichotomously coded for the regression analyses as either coursework plus thesis or coursework alone or with a major research paper. Finally, whether the student had ever taken a LOA during the time spent in the master's or doctoral program was coded simply as "yes" or "no".

Financial variables. These included type and amount of funding from nine different sources as well as the average amount of funding from all sources. Funding sources considered were internal scholarships, research, graduate and teaching assistantships (RAs, GAs and TAs), Ontario Graduate Scholarships (OGS), fellowships granted by the Social Sciences and Humanities Research Council (SSHRC), the National Science and

Engineering Research Council (NSERC) or the Medical Research Council (MRC), as well as a miscellaneous category including various other grants and scholarships.

To accommodate variability in program regulations relevant to student support (e.g., TAs are not permitted for master's students in some disciplines), to minimize variation in levels of support across programs and years, and to avoid a time confound, the predictor employed was an averaged amount of funding from each source over the student's participation in the graduate program. Monetary values (considered across students by year) were transformed into z-scores. The standardized scores were then averaged across an individual student's "history" in the graduate degree program to produce a "profile" of that student's earnings in each of the financial categories.

Interaction terms. As recommended by Hosmer and Lemeshow (1989), interaction terms used were chosen on the basis of interpretability, logic, and support received in the literature. Five interaction terms were computed: gender by marital status, gender by registration status, registration status by marital status, gender by type of program, and registration status by type of program. The latter two interactions were not utilized in the regression analyses for doctoral students since all doctoral candidates are required to complete a dissertation.

Dependent variable. Separate multiple regression analyses (SPSS, 1988) were carried out for master's and doctoral students. In both cases, the dependent variable was the student's length of time in the program, computed as the time elapsed between date of entry into the graduate program and date of conferral of the master's or doctoral degree.

In both analyses, the regression equation was built with forward, stepwise entry. It should be noted, however, that identical results were obtained with backward regression. Stepwise regression provides a useful and effective means of studying outcomes which have received little prior attention or are unknown (Draper & Smith, 1981). P-in was set at 0.05 and p-out at 0.10 in order to identify as many possible predictors of length of time to degree completion as possible.

Following Hosmer and Lemeshow (1989), the procedure utilized for selection of significant independent variables and interactions involved: (1) stepwise selection of main effects; (2) forced entry of the main effects significant on step (1); (3) stepwise selection of interaction terms given the main effects variables in the model.

Results

Sample Characteristics

Descriptive data for the sample of 395 master's and 79 doctoral students, disaggregated by level of study and selected demographic and academic independent variables, are presented in Table 1. Univariate statistical analyses are not reported here, given the results of the more elaborate multiple regression solutions, but may be found in Sheridan (1990).

Table 1

Length of Time to Degree Completion for Graduated Students by Level and Selected Demographic and Academic Independent Variables

Master's			Doctoral	
N	Mean	**COMPARISON VARIABLE**	N	Mean
		GENDER		
242	2.34	Male	48	5.22
153	2.36	Female	31	5.92
		REGISTRATION STATUS		
317	2.10	F/T	74	5.51
78	3.37	P/T	5	5.25
		CITIZENSHIP		
284	2.45	Canadian	52	5.26
49	2.44	Landed Immigrant	12	6.12
62	1.82	Foreign	15	5.80
		DISCIPLINE AREA		
83	2.54	Natural Science	15	3.53
188	2.39	Social Science	48	5.97
124	2.16	Humanities	16	5.89
		PROGRAM TYPE		
183	2.01	Course	–	–
114	2.45	MRP	–	–
98	2.86	Thesis	79	–
395	2.35	**TOTAL**	79	5.49

Regression Analysis — Master's Students

The results of the regression solution for master's students are presented in Table 2. Only seven of the 20 possible independent variables were significantly related to a graduated student's length of time in a master's program. Of the demographic variables, two are significant predictors of length of time to degree completion. Registration status is the single most important independent variable, accounting for approximately 16% of the variance in length of time to degree completion. Full-time status decreases length of time to degree completion. The second significant demographic variable, citizenship, reveals that Canadian citizenship is associated with longer times to degree completion.

Four of the academic variables (type of program, ever having taken a LOA, graduate GPA and discipline area) were significant predictors of length of time to degree completion. Enrolment in a program with a thesis requirement accounts for approximately 11% of the variance in the dependent variable and is the second most significant variable overall. A thesis requirement dramatically increases the length of time spent in the master's program relative to programs requiring coursework only or coursework plus a major research paper. As expected, taking a leave of absence at some point during the master's years increases the length of time spent in the program and accounts for roughly 6% of the variance. Participation in a humanities discipline decreases length of time required to complete the master's degree. Finally, higher graduate GPAs are found in conjunction with faster completion times.

Only one of the financial variables was found to be a significant predictor of length of time to degree completion at the master's level. As the average amount of funding from all sources (i.e., assistantships, scholarships and fellowships) increases, time spent in the program decreases. Of the interaction terms, only registration status by type of program was made available to the regression analysis (since both were significant main effects), and it was not significant. In total, the seven independent variables combined account for approximately 38% of the variance in length of time to degree completion at the master's level.

Regression Analysis — Doctoral Students

The results obtained from the regression analysis for doctoral students must be interpreted with some degree of caution because of the relatively small sample size (79) to predictor (19) ratio. Table 3 displays the results of the analysis.

Only five of the 19 variables available to the regression solution were statistically significant. Registration status and citizenship are again the only significant demographic variables, accounting for 6.4% and 4.4% respectively of the variance in length of time taken to complete doctoral programs. Full-time and Canadian students require less time overall to complete doctoral requirements as compared with part-time students and landed immigrant and foreign students. The only significant academic variable, accounting for 26% of the variance, is discipline, with students in natural science disciplines exhibiting the fastest completion times. Two of the financial variables added significantly to the

Table 2

Multiple Linear Regression of Length of Time to Master's Degree Completion

Variable	Beta In	Sig F	R^2*	R^2 Ch
Registration status	-.4010	.000	.1608	.1608
Thesis required	.3349	.000	.2680	.1071
Ever taken LOA	.2446	.000	.3274	.0594
Average funds	-.1997	.000	.3526	.0252
Graduate GPA	-.1067	.000	.3634	.0108
Humanities	-.0912	.000	.3707	.0073
Domestic citizen	.1103	.000	.3820	.0113

* Note: R^2 reflects the proportion of the original variance in the dependent variable accounted for by the regression equation with variables up to and including the row under examination.

Table 3

Multiple Linear Regression of Length of Time to Doctoral Degree Completion

Variable	Beta In	Sig F	R^2*	R^2 Ch
Natural Science	-.5122	.000	.2623	.2623
Grad assistantships	-.2635	.000	.3277	.0653
Domestic citizen	-.2101	.000	.3716	.0440
Average funds	-.2098	.000	.4100	.0384
Registration status	-.2772	.000	.4739	.0639

* Note: R^2 reflects the proportion of the original variance in the dependent variable accounted for by the regression equation with variables up to and including the row under examination.

regression solution. The average amount of funding received from all sources accounted for 3.8% of the variance and the average amount of funding from graduate assistantships accounted for 6.5% of the variance. In both cases, as the amount of funding increases, the length of time in the doctoral program decreases.

None of the interaction terms was made available to the regression analysis because the prior main effects were not significant. The five significant variables accounted for slightly more than 47% of the variance in length of time to degree completion at the doctoral level.

Discussion

Degree Progress at the Master's Level

The present investigation is one of the few studies to focus attention on the length of time required to complete master's degrees (Marr & McPherson, 1992; Sheridan, 1992). Although some of the results parallel those obtained from the research on doctoral degree progress, other findings were unique and merit further consideration.

The regression solution for master's students supports the findings of other researchers (Girves & Wemmerus, 1988; Ott, Markewich, & Ochsner, 1984) that registration status is an extremely important variable in degree progress at this level. In the present investigation, registration status accounts for the largest proportion of the variance in, and is the single most important predictor of, length of time to completion at the master's level. Being a full-time student significantly decreased length of time to degree completion. Part-time graduate students may be doubly disadvantaged since they face not only the difficulties of part-time study, but also appear to be of significantly lower academic standing at the point of admission than those registering as full-time candidates (Sheridan, 1990).

Assuming that grades reflect ability, higher-ability students complete their degrees faster than those of lower ability, although only about one per cent of the variance in the dependent variable is accounted for by graduate GPA. Undergraduate GPA was not a significant predictor of length of time to degree completion at the master's level. Given that undergraduate GPA is an important selector criterion for graduate study, this lack of relationship with the length of time to complete the degree suggests the need for further study of the relevance of undergraduate GPA to graduate work.

Students required to complete a thesis as part of their program take significantly longer to complete their master's degrees than those doing coursework only or coursework plus a major research paper, a finding in keeping with other studies (McLennan, cited in Marr & McPherson, 1992; Marr & McPherson, 1992). This is in spite of the fact that students undertaking the thesis option were significantly more likely than those in one of the other two types of programs to be of higher academic standing at the point of admission to the graduate program (Sheridan, 1990). This indicates that, higher GPA notwithstanding, completing a thesis project significantly delays one's progress in a master's program.

Ever having taken a LOA was also a predictor of length of time to degree completion at this level. Students who had ever taken a LOA required significantly longer to complete their degrees than those who had not. It should be noted that this finding is not necessarily intuitive; theoretically, although on an official LOA, students may continue to do some work on their thesis, and/or to complete outstanding course assignments — which might expedite their progress or at least not hinder it. This does not appear to be the case, however.

The average amount of funding received from all sources was the only financial variable significant in the regression solution for length of time to degree completion at the master's level. The finding that increased funding decreases length of time to degree completion supports the conclusion of many researchers (Abedi & Benkin, 1987; Bowen & Rudenstine, 1992; Fletcher & Stren, 1992; Tuckman *et al.,* 1989, 1990), that personally financing one's own education at the graduate level significantly increases time to degree completion. At the master's level, it does not appear that the source of financial support (e.g., assistantships vs. scholarships) affects length of time to completion, as is thought to be the case at the doctoral level (Abedi & Benkin, 1987; Bowen & Rudenstine, 1992; Tuckman *et al.,* 1990). This finding may reflect the relative rarity of large grants and fellowships (e.g., NSERC, SSHRC, MRC) at the master's level, and therefore indicates the greater importance of funding received from university sources (e.g., internal scholarships, RAs, GAs, TAs).

Being in a humanities discipline significantly decreased length of time to master's degree completion. This finding is notably independent of the influence of the type of program chosen by the student, which is itself significant in the regression solution. Expectations and program requirements for master's level candidates may be more precisely delineated in these disciplines, which, in combination with close supervision and monitoring, could yield faster completion times. In any event, further research is required to illuminate this result.

Finally, citizenship of the student was significantly related to length of time to degree completion at the master's level. These results support the observations of others that foreign students at both the master's and doctoral level complete degrees faster than domestic students (McLennan, cited in Marr & McPherson, 1992; Ott et al., 1984; Yeates, 1992). This may reflect the fact that foreign students are usually unable to work or to remain in the country if they withdraw from school, or the fact that such students are often under intense pressure to complete their degrees and return home to work.

Contrary to a number of other reports, gender of student was not a significant predictor of length of time to degree completion. Age and marital status were also not significant predictors of length of time to the master's or doctoral degree. Although these results replicate the findings of some other investigators (e.g., McLennan, cited in Marr & McPherson, 1992; Ott et al., 1984), they do not support the results reported by Tuckman et al. (1990) for doctoral degree completion.

Degree Progress at the Doctoral Level

Multiple linear regression, like all statistical procedures, is sensitive to sample size. The minimum suggested requirement for stepwise regression—four cases per independent variable—is far less than the ideal case-to-variable ratio of forty to one (Tabachnick & Fidell, 1983). The number of doctoral graduands in the present study (79) meets the minimum suggested case-to-variable ratio, but limits the generalizability of the information. An additional limitation is imposed in that the data derive from only one institution. Although the results obtained in this study appear to be more or less consistent with the findings reported by other researchers, the results of the multiple regression solution for doctoral students should be treated as preliminary, suggestive of possible variables for inclusion in future studies employing larger samples selected from several contributing universities across the country. Such future research could reveal important national trends as well as regional differences.

As was the case at the master's level, registration status is a highly significant predictor of length of time to completion of the doctorate. Being a full-time student significantly speeds progress through the doctoral program.

Citizenship also has a significant effect at the doctoral level but operates differently than at the master's level. In the present study, Canadian citizenship is associated with a significant decrease in the length of time spent in the doctoral program. These data are in direct contradiction to the information presented by Yeates (1991), who observed that foreign students completed degrees more quickly than domestic students. No statistical analyses were performed by Yeates, however, and closer examination reveals that the largest differences in completion time between foreign and Canadian students occurred in engineering and applied science disciplines. These disciplines are not represented in the present study. Foreign students may prolong their tenure at the doctoral level in order to remain in the country longer, hoping to obtain landed-immigrant status. Perhaps the financial advantages of remaining in Canada with attendant employment flexibility and opportunity decrease the attractiveness of returning to the home country. Furthermore, at the conclusion of the doctoral years, the student is likely very comfortable and established in his or her environment and perhaps does not look forward to resettlement. Bowen and Rudenstine (1992) note that "increasing numbers of non-U.S. residents have chosen to stay on (at least temporarily) after graduation to continue their studies or research" (p. 32).

Being in a natural science discipline significantly decreases length of time to degree completion at the doctoral level. This variable accounts for a substantial proportion of the variance in length of time to completion and is the single most important contributor to speed of doctoral degree completion. This result supports the findings of many other scholars that program/discipline characteristics influence doctoral degree progress (Baird, 1990; Bowen & Rudenstine, 1992; Duggan, 1989; Fletcher & Stren, 1992; Girves & Wemmerus, 1988; Yeates, 1991). Such differences in length of time to degree completion as a function of discipline have been observed consistently across cohorts and institutions

(Bowen & Rudenstine, 1992) and thus are considered to reflect intrinsic differences in the nature of graduate education in these disciplines.

Two of the financial variables, the average amount of funding received from all sources and the average amount of funding received from GAs, were significant predictors of length of time to degree completion at the doctoral level. Many authors have noted the importance of financial variables at the graduate level (Dolph, 1983; Teague-Rice, 1981; Tuckman et al., 1990). The findings of these investigators indicate that the less a student is forced to rely on personal finances, the better. The greater the amount of academically-linked financial support, the shorter the time required to complete the degree (Abedi & Benkin, 1987; Bowen & Rudenstine, 1992; Fletcher & Stren, 1992; Tuckman et al., 1990).

The second of these variables, average amount of funding received from GAs, requires a more complex explanation. Abedi and Benkin (1987) found that doctoral students receiving grants and fellowships took longer to complete their degrees than did those receiving teaching or research assistantships. They speculated that this may be because these sources of funding force the student to spend an increased amount of time pursuing non-degree-related activities rather than increasing the amount of time devoted to full-time work towards the doctorate. In contrast, Tuckman et al. (1990) found that receipt of teaching and research assistantships significantly increased the length of time required to complete doctoral degrees while receipt of fellowship support decreased the length of time to doctoral degree completion. Bowen and Rudenstine (1992) similarly report that although teaching assistantships encourage participation in the graduate study enterprise, reliance on them significantly lengthens time taken to complete the doctorate, a phenomenon which they believe is currently increasing. Tuckman and his colleagues speculate that receiving support from teaching and research assistantships is often contingent upon performing duties that detract from degree-related pursuits. They reason that if such duties were related to the student's degree, doctoral degree completion would be facilitated rather than hindered.

For students in the present sample, GAs typically involve activities that facilitate doctoral degree completion rather than detract from it. Receipt of GA funds involves performance of duties which neither require the student to forego activities related to completing the degree (as may be the case with RAs and TAs, according to Tuckman *et al.,* 1990), nor provide the student with an incentive to replace non-degree-related work with leisure activities rather than study time (as may be the case with grants and fellowships, according to Abedi and Benkin (1987)). Award of a GA allows students to receive payment for duties which do not detract from their degree progress, while at the same time their duties are regulated sufficiently (by the necessity of demonstrating progress as well as periodic evaluations by their supervisors), so that the incentive to replace work with leisure is not realizable.

Neither the gender nor the age variable was a significant predictor of length of time to the doctorate. This fails to confirm the finding of Tuckman et al. (1990) that age of the student at time of entry into graduate school is the single most significant factor in increasing length of time to degree completion. The sample employed in the present study was representative of the population in terms of student age; therefore. it appears that age is not a significant factor in degree progress at this university.

Neither incoming grades nor graduate grades were significant in the regression analysis for doctoral degree progress. This replicates the finding of Girves and Wemmerus (1988) that grades are associated with degree progress at the master's but not at the doctoral level. This may be a consequence of the attenuated role of grades in evaluation at the doctoral level as well as the selection of higher-ability students for doctoral work.

Neither marital status nor leaves of absence were significant predictors of length of time to degree completion at the doctoral level, although this may reflect the sample size deficiency noted above.

Summary and Implications

The results from the separate regression solutions for length of time to degree completion at the master's and doctoral levels reveal that slightly different factor matrices affect length of time to degree completion. Registration status, discipline area, citizenship, and funding are significant predictors of length of time to degree completion at both levels, but the direction of the effect for area of study and citizenship is not consistent across levels. Other significant influences on time to completion are only relevant for master's students (graduate GPA, the thesis requirement, LOA).

Although the findings reported here hint at possible mechanisms for expediting degree progress, the situation is complex and further research is required before proceeding to implement radical changes. For example, conducting a thesis research project seems to militate against timely master's degree completion. If academic administrators are eager to diminish length of time to completion at the master's level, instituting a coursework-only option in disciplines not currently offering such an option might be considered. However, it may be that successful completion of a thesis facilitates more expeditious and/or qualitatively superior dissertation research. A study should be undertaken to determine if this is indeed the case. Potential disadvantages faced by doctoral students who have not fulfilled a thesis requirement might be offset by increasing the amount of faculty supervision provided.

Similarly, although pursuing a degree on a part-time basis increases time to completion, restricting graduate study to a full-time model not only differentially limits accessibility but is inappropriate given the minimal level of support funding available for most students. Furthermore, given that part-time students typically receive no financial aid, they are not consuming monetary resources that could be directed to incoming students; and, therefore, part-time study may represent a cost-effective option for graduate training in some disciplines.

Clearly, the amount of financial support provided to graduate students affects time to completion. In this period of fiscal restraint, it is unlikely that current levels of support will be appreciably augmented, although this would operate to shorten the time taken to complete program requirements. Cooperative programs and/or paid internships or practica at the graduate level might alleviate the financial pressure on the student while at the same time freeing up some university resources which could then be made available to meet the escalating student demand for graduate study. Alternately, or in addition, the Yale model for funding senior students might be considered (Blum, 1990).

Among the intriguing findings of this research is the discovery that, at the master's level, those in humanities disciplines are faster completers than their counterparts in the natural sciences, while at the doctoral level, the reverse is true. With respect to the latter, Girves and Wemmerus (1988) have suggested that faculty in "hard" areas work within well-defined paradigms in which the content and methods that underlie research are well understood by those familiar with the paradigm. In "soft" areas, however, where research paradigms are less developed (and/or more variable), more time is required to describe and justify research, to delimit methodological approaches, and to establish criteria for evaluating such approaches (Biglan, 1973a, 1973b). Unfortunately, this very plausible construction does not explain the faster performance of humanities students at the master's level. One possible interpretation is that the discontinuity between undergraduate and master's level training in natural science disciplines is significantly greater than that in humanities disciplines. Conversely, at the doctoral level, the disjunction between the master's and doctoral level may be greater for humanities subjects than for natural science disciplines. These two propositions would account for the pattern of results obtained in the present study but must be tested in further research.

Decreasing the length of time required to complete the doctorate is viewed by some as the most critical problem facing graduate education at the present time (Tuckman *et al.*, 1990). Increased TTD has many negative consequences, including lengthening the amount of time required for the supply of new doctorates to respond to shifts in market demand, discouraging students from pursuing training at the doctoral level or encouraging enrolled students to withdraw before completing their degrees, and decreasing the productivity of new doctorates by reducing the number of years spent working by degree-holders. Tuckman et al. note, however, that the data currently available to permit policy-makers to choose the best means of reversing increased time to the doctorate or to evaluate the consequences of any proposed solutions are as of yet still inadequate for such decision-making. Nevertheless, in the absence of definitive research, the Canadian Association of Graduate Schools (1987) has approved a document containing a number of recommendations designed to facilitate or expedite a student's progress through graduate program requirements. More recently, Yeates (1991) has similarly generated a set of recommendations geared to improve graduation rates and time to completion. The present study contributes additional information to this growing body of literature on master's and doctoral degree progress and provides some direction for future research considerations.

References

Abedi, J., & Benkin, E. (1987). The effects of students' academic, financial, and demographic variables on time to the doctorate. *Research in Higher Education, 27,* 3-14.

Baird, L.L. (1990). Disciplines and doctorates: The relationships between program characteristics and the duration of doctoral study. *Research in Higher Education, 31,* 369-385.

Berelson, B. (1960). *Graduate education in the United States.* New York: McGraw-Hill.

Berg, H.M., & Ferber, M.A. (1983). Men and women graduate students: Who succeeds and why? *Journal of Higher Education, 54,* 629-648.

Biglan, A. (1973a). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology, 57,* 195-203.

Biglan, A. (1973b). Relationships between subject matter characteristics and the structure and output of university departments. *Journal of Applied Psychology, 57,* 204-213.

Blum, D.E. (1990, August 8). Yale plan to shorten duration of doctoral studies angers faculty members and graduate students. *Chronicles of Higher Education,* pp. 9, 12.

Bowen, W.G., & Rudenstine, N.L. (1992). *In pursuit of the Ph.D.* Princeton, N.J.: Princeton University Press.

Canadian Association of Graduate Schools. (1987). *On the time taken to complete graduate research degrees.* Ottawa, Ontario, Canada: Author.

Carmichael, O.C. (1961). *Graduate education: A critique and a program.* New York: Harper & Brothers.

Cude, W. (1991). The need for improved doctoral program statistics. *Canadian Journal of Higher Education, 21,* 1-6.

Dolph, R.F. (1983). *Factors relating to success or failure in obtaining the doctorate.* Unpublished doctoral dissertation, Georgia State University.

Draper, N.R., & Smith, H. (1981). *Applied regression analysis* (2nd ed.). New York: John Wiley & Sons.

Duggan, J J. (1989). *Time to the doctoral degree and success rates: The Berkeley experience.* Unpublished data, University of California at Berkeley.

Evangelauf, J. (1989, March 15). Lengthening of time to earn a doctorate causes concern. *Chronicle of Higher Education,* 13-14.

Filteau, C. (Ed.). (1992). *Graduate graduation rates and time-to-completion: Colloquium proceedings.* Toronto, Ontario, Canada: Ontario Council on Graduate Studies.

Fletcher, J., & Stren, R. (1992). Discussion of the factors influencing time-to-completion in graduate programmes: Student views. In C. Filteau (Ed.), *Graduate graduation rates and time-to-completion: Colloquium proceedings.* Toronto, Ontario, Canada: Ontario Council on Graduate Studies.

Girves, J.E., & Wemmerus, V. (1988). Developing models of graduate student degree progress. *Journal of Higher Education, 59,* 163-189.

Harmon, L. (1978). *A century of doctorates: Data analysis of growth and change.* Report for the National Research Council. Washington, D.C.: National Academy Press.

Hosmer, D.W., Jr., & Lemeshow, S. (1989). *Applied logistic regression.* New York: John Wiley & Sons.

MacMillan, B. (1989). The flow-through hypothesis: A review of the data. In C. Filteau (Ed.), *Proceedings of a conference of women in graduate studies in Ontario.* Toronto, Ontario, Canada: Ontario Council on Graduate Studies.

Marr, W., & McPherson, B. (1992). Graduation rates and time-to-completion in master's-only programmes. In C. Filteau (Ed.), *Graduate graduation rates and time-to-completion: Colloquium proceedings.* Toronto, Ontario, Canada: Ontario Council on Graduate Studies.

National Research Council. (1989). *Summary Report 1987: Doctoral recipients from United States universities.* Washington, D.C.: Author.

Ott, M.D., Markewich, T.S., & Ochsner, N.L. (1984). Logit analysis of graduate student retention. *Research in Higher Education, 21,* 439-460.

Pyke, S.W., & Sheridan, P.M. (1993). Logistic regression analysis of graduate student retention. *Canadian Journal of Higher Education, 23,* 44-64.

Sheinin, R. (1989). Review of the implementations of the recommendations of the Report on the "Status of Women in Ontario Universities." In C. Filteau (Ed.), *Proceedings of a conference of women in graduate studies in Ontario.* Toronto, Ontario, Canada: Ontario Council on Graduate Studies.

Sheridan, P.M. (1992). Factors influencing graduation rates and time-to-completion in master's programmes at York University. In C. Filteau (Ed.), *Graduate graduation rates and time-to-completion: Colloquium proceedings.* Toronto, Ontario, Canada: Ontario Council on Graduate Studies.

Sheridan, P.M. (1990). *Effects of demographic, academic and financial variables on graduate-student persistence, withdrawal and degree progress at York University.* Unpublished master's thesis, York University, North York, Ontario, Canada.

SPSS. (1988). *SPSS-X user's guide* (3rd ed.). Chicago: Author.

Tabachnick, B.G., & Fidell, L.S. (1983). *Using multivariate statistics.* Cambridge, M.A.: Harper & Row.

Teague-Rice, L. (1981). *A profile of the female doctoral student who persisted to the completion of the doctoral degree.* Unpublished doctoral dissertation, Auburn University.

Tuckman, H.P., Coyle, S., & Bae, Y. (1989). The lengthening of time to completion of the doctorate degree. *Research in Higher Education, 30,* 503-516.

Tuckman, H.P., Coyle, S., & Bae, Y. (1990). *On time to the doctorate.* Washington, DC: National Academy Press.

Yeates, M. (1991). *Doctoral graduation rates in Ontario universities.* Toronto, Ontario, Canada: Council of Ontario Universities/Ontario Council on Graduate Studies.

The Ph.D. Dilemma in Canada Revisited

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Abstract

Growth of doctoral studies at Canadian universities in the last two decades has resulted in the more than 1,000 programs that are now offered. Not surprisingly, the output of Ph.D. graduates has increased six-fold since the early sixties. But during the seventies, an imbalance between the rising supply of Ph.D.s and the declining demand for them, particularly in higher education, became apparent. This paper traces historical trends in the employment of Canada's Ph.D. holders and looks at their prospects for the future.

Traditionally about 65% of doctoral graduates have entered educational occupations. Today, because of the youthful age structure, there are few retirements or deaths, and hence, the annual replacement demand is for only about 500 Ph.D.s. But Canadian universities now confer around 2,000 doctorates each year (including returning Canadians from abroad).

Moreover, this imbalance is apt to persist. On the basis of the current enrolment of 13,000, the Ph.D. supply has been projected from 1977–78 to 1981–82 for 45 disciplines. Relating these supply estimates to the likely demand for university teachers reveals a potential surplus in almost every discipline. A cycle of shortage and surplus appears to have developed in some fields. These simulations have been derived from assumptions, which our outlined in two appendices and 26 supporting tables.

In addition, this paper also examines other features of the Ph.D. situation in Canada: a history of the growth of graduate education; variations in the ratio of Ph.D. enrolment to graduates in different disciplines; support programs for doctoral students, and the immigration of university teachers. The information provides an overview of the many dimensions of the Ph.D. issue.

Résumé

La croissance de l'intérêt pour les études au doctorat a été telle au cours des deux dernières décennies, que plus de 1,000 programmes sont présentement offerts dans les universités canadiennes. D'où la constatation que le nombre de détenteurs d'un doctorat soit six fois plus grand depuis les années 60. Toutefois, au cours des années 70, un déséquilibre s'est manifesté, surtout dans le domaine de l'enseignement supérieur, entre le nombre croissant de diplômés d'un doctorat d'une part et la demande d'inscription à ce même niveau d'autre part. La présente étude veut tout à la fois tracer les tendances historiques en regard de l'utilisation des diplômes d'un doctorat des universités canadiennes et jeter un regard sur les perspectives d'avenir.

Traditionnellement, environ 65% des diplômes d'un doctorat s'orientaient vers des carrières dites pédagogiques. A l'heure actuelle, à cause du jeune âge du personnel enseignant, on y compte peu de retraités ou de gens qui décèdent, ce qui explique des demandes annuelles de seulement 500 nouveaux diplômés d'un doctorat pour remplir les postes existants. Toutefois, les universités canadiennes décernent actuellement environ 2,000 doctorats par an (y compris les canadiens qui reviennent d'un stage dans un autre pays).

D'ailleurs, il est à prévoir que ce déséquilibre aura tendance à se perpétuer. En se basant sur les 13,000 inscriptions actuelles à des programmes de doctorat, une projection a été faite de l'offre des candidats en regard des années 1977–78 à 1981–82, pour 45 disciplines. En juxtaposant ces projections de l'offre par rapport à la demande probable pour des enseignants universitaires, un surplus se révèle dans presque toutes les disciplines. Un cycle de pénurie et de surplus paraît s'être développé dans certaines disciplines. Ces simulations proviennent des hypothèses contenues dans deux appendices et vingt-six ciannexés.

De plus, cette étude se penche également sur d'autres aspects de la situation des doctorats au Canada; une histoire de la croissance de l'enseignement supérieur; des écarts dans le rapport des inscriptions au doctorat dans de différentes disciplines; les programmes de soutien pour des candidats au doctorat et l'immigration d'enseignants universitaires. Ces information fournissent un aperçu général des dimensions multiples de l'utilité du doctorat au Canada.

Introduction

By 1971, the imbalance between the growing supply of Ph.D. graduates and the declining demand for them, particularly in the university sector, had become apparent. The Economic Council explored this issue in a report published in *Canadian Higher Education in the Seventies* in 1972.[1] The information available then was limited, but now many of the questions raised can be answered more authoritatively on the basis of recent data. The purpose of this report is to provide that data, and at the same time, discuss some of the issues.

This report is organized into four sections and two appendices. The first section presents a statistical outline of the Ph.D. situation in Canada: the Ph.D. population, (e.g., employment sector, occupation, immigration status and university teachers' characteristics), degrees granted, and employment trends. The second investigates the enrolment pattern of full-time and part-time doctoral students by field of study and legal residence status. It also gives, on a provincial basis, the number of Canada Student loan Plan recipients, and the number of Canada Council Doctoral Fellows by discipline. The third section deals with the structure of doctoral programs at Canadian universities, particularly the increasing number of graduate programs, and discusses the growth pattern for selected disciplines. In addition, Ph.D. enrolment is related to the number of degrees granted by discipline. The last section focuses on the anticipated supply and demand of Ph.D.s in the university sector for 1977–78 to 1981–82.

The Ph.D. Situation: Basic Statistics

Employment

The Highly Qualified Manpower Survey of 1973 presented, for the first time, and excellent overview of how Canada's Ph.D. population was employed.[2] By 1973, according to this survey, 27,410 residents of Canada had earned a doctorate. Of those who were part of the labour force, 64.8% were working in education (Table 1). The various levels of government employed 14.7% (11.7% in the federal government alone), and the industrial sector accounted for about 13.5%

An occupational breakdown reflects this distribution of Ph.D.s among employment sectors. About half (50.8%) were university teachers, while other educational institutions employed 4.4% (Table 2). In addition, 4.7% were educational administrators. Chemists, geologists, engineers, and similar scientific occupations constituted a large component (20.9%). Another group (7.8%) functioned as administrators and managers in both government and industry.

Replacement

A unique characteristic of Canada's Ph.D. population is its relative youth. In the educational sector, two-thirds are younger than 44, and their average age has been estimated at 40. This means that for the next ten to fifteen years attrition due to retirement and death will be low. The current annual attrition rate, about 1.3%, opens about 500 replacement positions for Ph.D.s in all sectors of employment each year. However, around 2,000 Ph.D.s become available for employment annually, and demand in education and government is not expanding. The imbalance is apparent.

But the present age structure suggests a substantial replacement demand for Ph.D.s in 15 years, particularly in education. Since the average time to complete a Ph.D. is five years from the masters or equivalent level, the question of supply needs to be explored before the late eighties.

Table 1

Employment of Ph.D.s by industrial sector and by age, 1973

Industrial Sector	Younger than 34 %	34-44 %	Older than 44 %	Number	Percent*
Primary industries (e.g., agriculture, mining)	19.6	37.1	43.3	485	(1.8)
Manufacturing	26.7	36.4	36.4	1,290	(4.9)
Service industries (e.g., transportation, trade, finance)	24.7	27.2	46.9	395	(1.5)
Education and related	24.1	43.0	33.0	17,120	(64.8)
Health and welfare services	21.5	39.0	39.5	1,000	(3.8)
Religious organizations	1.6	18.5	79.8	620	(2.3)
Other services (e.g., community, business personal)	18.2	20.5	56.8	225	(0.8)
Business management	26.0	35.4	39.0	1,290	(4.9)
Federal administration	20.5	37.3	42.0	3,090	(11.7)
Provincial administration	24.5	34.7	42.2	735	(2.8)
Municipal administration	30.0	40.0	40.0	50	(0.2)
Industry as unspecified or undefined	41.7	29.2	29.2	120	(0.4)
Total	**23.1**	**39.1**	**37.8**	**26,405**	**(100.0)**

* Percentage in brackets provide the breakdown by industrial sector.
Source: Statistics Canada, unpublished data

Table 2

Selected Occupations of Ph.D.s by Gender, 1973

Selected Occupation	Male	%	Female	%	Total	%*
Government administrators	455	94.8	20	5.2	480	(1.8)
General managers & senior officers	580	100.0	--	0.0	580	(2.2)
Administrators in teaching	1,175	94.4	65	5.6	1,245	(4.7)
Other managers & administrators	915	94.3	55	5.7	970	(3.8)
Chemists	1,490	94.6	90	5.4	1,575	(6.0)
Geologists	605	99.2	10	0.8	610	(2.3)
Agriculturists & related	570	100.0	--	0.0	570	(2.1)
Other natural scientists	1,150	94.3	75	5.7	1,220	(4.6)
Engineers, architects, system analysts	1,490	96.1	60	3.9	1,550	(5.9)
Economists	185	94.9	5	5.1	195	(0.7)
Psychologists	295	80.8	65	19.2	365	(1.4)
Judges & lawyers	115	92.0	10	8.0	125	(0.5)
Other social scientists	200	78.4	60	21.6	255	(1.0)
Ministers of religion	570	96.6	20	0.0	590	(2.2)
University teachers	12,155	90.5	1,270	9.5	13,425	(50.8)
Elementary & secondary teachers	260	82.5	55	17.5	315	(1.2)
Postsecondary, non-university teachers	410	82.0	90	18.0	500	(1.9)
Other teachers & related	225	67.2	110	32.8	335	(1.3)
Physicians & surgeons	320	95.5	10	4.5	335	(1.3)
Dentists	20	100.0	--	0.0	25	(0.1)
Pharmacists	50	76.9	10	23.1	65	(0.2)
Other health occupations	50	90.9	5	9.1	55	(0.2)
Writers, editors & related occupations	140	77.8	35	22.2	180	(0.7)
Clerical & service	105	95.5	10	4.5	110	(0.4)
Military & policy officers	160	97.0	5	3.0	165	(0.6)
Other occupations	205	97.6	10	2.4	210	(0.8)
Not stated	105	84.0	20	16.0	125	(0.5)
Total	**23,985**		**2,165**	**9.0**	**26,405**	**(100.0)**

* Percentage in brackets provide breakdown by occupation.
Source: Statistics Canada, unpublished data

Citizenship

In the past, Canada has relied on immigrants for highly qualified manpower; 57.6% of the 1983 Ph.D. population were immigrants. In addition, a large number of Canadians have obtained their degrees abroad. The 1973 survey showed that 31.9% of the Ph.D. population, including Canadian citizens and landed immigrants, completed their doctoral studies in the United States, and 22.9% in Europe (Table 3).

Examination of the country of birth of foreign-born Ph.D.s reveals that 25.0% came from the United Kingdom, 24.5% from the United States and a similar proportion from other European countries combined (Table 4). Almost 45% of them entered Canada between 1966 and June 1971.[3]

University Teachers

Historically, more than half of the Ph.D.s have been employed as university teachers. During the last 20 years, Canadian universities underwent remarkable growth. The number of full-time teachers increased sixfold, from less than 5,000 in 1956–57 to almost 30,000 in 1974–75 (Table 5). The most spectacular expansion took place in the social sciences, which grew from 931 to 9,863. In comparison, the physical and applied sciences increased from 1,491 and 6,637.

Between 1963–64 and 1972–73 the average annual increase in the number of university teachers was about 2,000, excluding the few hundred replacement positions that were filled. This is meant that between 2,200 and 2,400 full-time teachers were hired each year, and approximately half had a Ph.D. Many of them were landed immigrants. According to immigration statistics, 17,713 immigrants whose intended occupation was university teaching were admitted to Canada between 1962 and 1974.[4] Most came from the United States (45.3%) and Great Britain (19.3%) (Table 6). Between 1972 and 1974, more than 1,200 immigrants whose intended occupation was university teaching entered the country each year, although the number of available positions had drastically declined. Unfortunately, information about the Ph.D. qualifications of landed immigrants who plan to teach at a university is not available. Table 7 shows characteristics such as average age and salary, proportion of females, and citizenship of university teachers in 1973–74. Faculties have been grouped into 47 disciplines under with teaching fields. As an illustration, there were 1,465 (5.1%) faculty members teaching English; 1,229 (4.3%) psychology; and 1,162 (3.5%) chemistry. Two-thirds were Canadian citizens, with some variations among disciplines; 13% were female, but women were concentrated in fine arts, modern languages, literature, education, social work, and household sciences. The proportion who held a doctorate was 56.8% for all disciplines, with a high of 82.0% in the physical sciences.

Federal Government Employees

Traditionally, the federal government has also been a major employer of doctoral graduates. According to the Highly Qualified Manpower Survey, 3,090 Ph.D.s (11%) worked for the government in 1973. From Public Service Commission data it was possible to

Table 3

Geographic Origin of Ph.D.s, 1973

	Numbers by country	Numbers by region	Percent
Canada			
Atlantic provinces	295 (2.5)		
Quebec	3,295 (28.4)		
Ontario	5,280 (45.5)		
Manitoba	370 (3.2)		
Saskatchewan	355 (3.1)		
Alberta	1,100 (9.5)		
British Columbia	900 (7.8)		
Total	**(100.0)**	**11,595**	**42.4**
United States		**8,730**	**31.9**
Europe			
Czechoslovakia	195 (3.1)		
France	815 (13.0)		
Germany	215 (3.4)		
Italy & Holy See	430 (6.9)		
Switzerland	170 (2.7)		
United Kingdom	3,820 (61.0)		
Others	615 (9.8)		
Total		**6,260**	**22.9**
Australia & New Zealand		**260**	**0.9**
Asia (primarily India)		**370**	**1.4**
Other countries (e.g., Africa, Latin America)		**160**	**0.6**
TOTAL, all countries		**27,410**	**100.0**

Percentage in brackets provides regional breakdowns.

Table 4

Foreign Born Ph.D.s by Country of Birth and Period of Immigration, 1973

	Before 1955		1956–60		1961–65		1996–June 1971		total number	%*
	no.	%	no.	%	no.	%	no.	%		
Europe										
United Kingdom	1,040	29.9	595	17.1	555	15.0	1,285	36.9	3,480	(25.0)
Germany	225	46.4	60	12.4	70	14.4	135	27.8	485	(3.5)
Soviet Union	335	77.9	30	7.0	15	3.5	50	11.6	430	(3.1)
Poland	225	63.4	40	11.3	20	5.6	70	19.7	355	(2.6)
France	85	27.0	20	6.3	75	23.8	125	39.7	315	(2.9)
Netherlands	145	56.9	60	23.5	45	17.6	15	5.9	255	(1.8)
Hungary	85	29.8	130	45.6	20	7.0	55	19.3	285	(2.0)
Czechoslovakia	70	21.5	5	1.5	10	3.1	225	69.2	325	(2.3)
Yugoslavia	60	57.1	5	4.8	15	14.3	20	19.0	105	(0.8)
Austria	70	66.7	10	9.5	10	9.5	15	14.3	105	(0.8)
Belgium	50	34.5	15	10.3	45	31.0	35	24.1	145	(1.0)
Greece	25	25.0	45	45.0	--	0.0	25	25.0	100	(0.7)
Spain & Portugal	10	10.0	15	15.0	25	25.0	50	50.0	100	(0.7)
Others (Europe)	145	33.0	55	12.5	75	17.0	155	35.2	440	(3.2)
United States	435	12.7	220	6.4	600	17.6	2,110	61.8	3,415	(24.5)
India	60	5.7	95	9.0	250	23.8	665	62.4	1,050	(7.5)
China	80	16.7	50	10.4	125	26.0	215	44.8	480	(3.4)
Japan	25	18.5	--	0.0	25	18.5	80	59.3	135	(1.0)
Egypt & Libya	10	4.5	50	22.7	60	27.3	105	47.7	220	(1.6)
Other countries	60	10.3	75	12.9	140	24.1	295	50.9	580	(4.2)
TOTAL all countries	3,475	25.0	1,780	12.8	2,430	17.5	6,230	44.8	13,915	

* Percent in brackets show geographic distribution.

Table 5

Full-time University Teachers by Field of Study, 1956-57 to 1974-75

	Social Sciences	Increase over previous year	Humanities	Increase over previous year	Sub-total Human Sciences	Increase over previous year	Life Sciences	Increase over previous year	Physical and Applied Sciences	Increase over previous year	Sub-total Natural Sciences	Increase over previous year	Grand Total	Increase over previous year
1956 – 1957	931		1,181		2,112		1,370		1,491		2,861		4,973	
1957 – 1958*	1,028	97	1,280	99	2,308	196	1,275	– 95	1,565	74	2,840	– 21	5,148	175
1958 – 1959	1,126	98	1,380	100	2,506	198	1,181	– 94	1,638	73	2,819	– 21	5,325	177
1959 – 1960*	1,276	150	1,524	144	2,800	294	1,248	67	1,840	202	3,088	269	5,888	563
1960 – 1961	1,427	151	1,669	145	3,096	296	1,317	69	2,041	201	3,358	270	6,454	566
1961 – 1962*	1,630	203	1,878	209	3,508	412	1,432	115	2,232	191	3,664	306	7,172	718
1962 – 1963	1,834	204	2,087	209	3,921	413	1,546	114	2,423	191	3,969	305	7,890	718
1963 – 1964	2,210	376	2,484	397	4,694	773	1,740	194	2,691	268	4,431	462	9,125	1,235
1964 – 1965*	2,671	461	2,945	461	5,616	922	1,960	220	3,027	336	4,987	556	10,603	1,478
1965 – 1966	3,133	462	3,406	461	6,539	923	2,183	223	3,363	336	5,546	559	12,085	1,482
1966 – 1967*	3,904	771	3,994	588	7,898	1,359	2,651	468	3,843	480	6,494	948	14,392	2,307
1967 – 1968	4,676	772	4,583	589	9,259	1,361	3,121	470	4,323	480	7,444	950	16,703	2,311
1968 – 1969	5,424	748	5,073	490	10,497	1,238	3,596	475	4,771	448	8,367	923	18,864	2,161
1969 – 1970	6,430	1,006	5,850	777	12,280	1,783	4,087	491	5,472	701	9,559	1,192	21,839	2,975
1970 – 1971	7,528	1,098	6,626	776	14,154	1,874	4,789	702	5,661	189	10,450	891	24,604	2,765
1971 – 1972	8,598	1,070	6,972	346	15,570	1,416	5,244	455	6,149	488	11,393	943	26,963	2,359
1972 – 1973	8,846	248	7,138	166	15,984	414	5,493	249	6,393	244	11,886	493	27,870	907
1973 – 1974	9,257	411	7,048	– 90	16,305	321	5,834	341	6,400	7	12,234	348	28,539	669
1974 – 1975**	9,863	606	7,168	120	17,031	726	6,042	208	6,637	237	12,679	445	29,710	1,171

* Estimated

** Includes for the first time Ryerson Polytechnical Institute with 623 faculty members, accounting for over 50% of the increase

Source: Statistics Canada, unpublished data

Table 6

Immigrants to Canada by Country of Last Permanent Residence and Intended Occupation: "University Teaching," 1962-1974

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Total 1962-74
Great Britain	95	160	195	271	353	457	545	499	284	143	117	155	140	3,414
Percent	24.4	29.7	29.0	25.0	25.0	23.6	23.9	20.8	15.1	10.5	11.3	10.5	11.7	19.3
France	25	30	27	42	69	81	87	90	105	77	73	94	86	886
Percent	6.4	5.6	4.0	3.9	4.9	4.1	3.8	3.8	5.5	5.7	7.2	6.3	7.2	5.0
Other Western European countries	41	39	58	77	97	142	175	157	155	61	75	96	92	1,265
Percent	10.5	7.2	8.6	7.1	6.9	7.2	7.7	6.5	8.2	4.5	7.3	6.5	7.7	7.1
India, Pakistan	14	38	31	81	86	131	99	177	120	87	54	89	56	1,063
Percent	3.6	7.1	4.6	7.5	6.1	6.6	4.3	7.4	6.4	6.4	5.2	6.0	4.7	6.0
Other Asia	4	14	6	27	49	89	124	128	166	80	53	180	113	1,033
Percent	1.0	2.6	0.9	2.5	3.5	4.5	5.4	5.3	8.8	5.9	5.1	12.2	9.4	5.8
United States	174	208	267	477	615	857	1,013	1,040	918	774	556	708	588	8,195
Percent	44.6	38.6	39.7	44.0	43.6	43.2	44.4	43.4	48.7	57.0	53.9	47.8	49.1	46.3
All other countries	37	50	88	109	141	229	237	307	138	136	103	159	123	1,857
Percent	9.5	9.3	13.1	10.1	10.0	11.5	10.4	12.8	7.3	10.0	10.0	10.7	10.2	10.5
TOTAL	**390**	**539**	**672**	**1,084**	**1,410**	**1,986**	**2,280**	**2,398**	**1,886**	**1,358**	**1,031**	**1,481**	**1,198**	**17,713**

Source: Department of Manpower and Immigration, unpublished data

Table 7

Characteristics of University Teachers by Discipline

Discipline	Number	Percent	% with Doctorate	Average Age	Average Salary	% Canadian Citizen	% Female
Physical Education	632	2.2	29.3	--	$ 15,659	--	--
Education	2,050	7.2	43.5	--	18,255	--	--
Subtotal Education	**2,682**	**9.4**	**40.1**	**40.6**	**17,632**	**76.3**	**21.3**
Music	425	1.5	22.8	--	15,670	--	--
Fine & Applied Arts	623	2.2	15.9	--	15,408	--	--
Subtotal Fine Arts	**1,048**	**3.7**	**18.7**	**39.9**	**15,513**	**59.6**	**18.7**
Classics	269	1.0	62.0	41.5	17,826	--	14.9
History	1,037	3.6	68.0	39.4	17,320	66.2	7.8
Library and Records Science	93	0.3	23.9	44.8	18,314	--	50.0
Mass Media Studies	83	0.3	17.7	40.7	16,829	--	5.0
English	1,465	5.1	60.7	40.6	16,814	59.4	20.2
French	776	2.7	47.8	40.4	16,099	63.1	28.6
German	224	0.8	72.3	41.3	16,597	--	23.0
Spanish	156	0.6	52.3	40.6	15,738	--	28.1
Other Modern Languages	667	2.3	49.9	40.2	16,581	--	19.9
Philosophy	693	2.5	67.0	39.9	17,934	59.4	5.4
Religious Studies	537	1.9	60.1	43.0	16,436	--	4.7
Subtotal Humanities	**6,000**	**21.0**	**58.9**	**40.5**	**16,904**	**62.1**	**16.6**
Anthropology	331	1.2	61.8	38.6	16,834	41.0	17.8
Area Studies	119	0.4	62.8	--	17,701	--	--
Commerce, Business Administration	1,051	3.7	39.1	37.4	17,727	72.1	4.6
Economics	904	3.1	63.8	38.3	18,563	63.3	4.2
Geography	609	2.1	66.7	37.4	17,250	53.7	3.6
Law	504	1.8	16.5	35.5	19,007	77.1	5.4
Political Science	691	2.4	58.6	38.0	17,736	64.4	7.4
Psychology	1,229	4.3	77.0	37.2	17,173	58.2	15.9
Social Work	289	1.0	23.4	42.6	17,917	81.3	33.2
Sociology	848	3.0	55.7	38.1	16,491	55.5	14.7
Subtotal Social Sciences	**6,575**	**23.0**	**55.4**	**37.9**	**17,607**	**62.3**	**10.2**
Agriculture	412	1.5	79.8	43.4	19,797	80.8	3.0
Biology	697	2.4	83.1	40.6	18,767	65.8	10.5
Botany	191	0.7	89.2	40.6	18,367	--	11.9
Household Science & Related	238	0.8	38.9	41.0	16,087	--	77.8
Veterinary Medicine & Sciences	135	0.5	40.7	37.2	17,567	--	5.0
Zoology	315	1.1	89.2	40.1	18,391	61.4	8.7
Subtotal Biological Sciences	**1,988**	**7.0**	**76.1**	**40.8**	**18,468**	**69.6**	**15.7**

Table 7 (continued)

Discipline	Number	Percent	% with Doctorate	Average Age	Average Salary	% Canadian Citizen	% Female
Architecture	188	0.7	7.7	40.1	17,474	--	3.8
Chemical Engineering	241	0.8	87.2	40.5	20,231	--	0.4
Civil Engineering	444	1.6	57.8	41.1	19,512	--	0.4
Electrical Engineering	286	1.0	72.7	40.2	19,600	--	0.7
Mechanical Engineering	331	1.1	63.6	40.9	19,629	--	0.3
Mining Engineering	109	0.4	72.6	41.3	19,943	--	0.9
Forestry	81	0.3	50.6	40.2	18,434	--	0.3
Other Applied Sciences	502	1.7	--	--	-------	--	--
Subtotal Applied Sciences	**2,182**	**7.6**	**59.7**	**40.6**	**19,175**	**72.3**	**0.7**
Dentistry	260	0.9	18.7	41.4	22,201	--	9.2
Medicine	3,032	10.6	42.7	41.8	21,745	--	11.1
Nursing	431	1.5	3.9	39.1	13,333	--	98.7
Pharmacy	143	0.5	79.6	40.8	18,873	--	10.2
Subtotal Health Professions	**3,846**	**13.5**	**38.2**	**41.4**	**20,764**	**73.4**	**20.6**
Mathematics	1,315	3.9	78.2	37.8	18,016	57.3	5.3
Chemistry	1,162	3.5	90.3	39.9	19,449	66.4	5.7
Geology and Related	516	1.5	86.9	40.1	19,108	66.4	1.4
Physics	1,124	3.9	86.6	38.6	18,383	69.3	3.0
Subtotal Physical Sciences	**4,218**	**14.8**	**82.0**	**38.9**	**18,618**	**63.2**	**4.1**
GRAND TOTAL	**28,539**	**100.0**	**56.8**	**40.0**	**18,369**	**66.3**	**13.0**

ascertain the length of employment and the discipline of study of the 2,293 hired under the Public Service Employment Act (Table 8).[5] During the sixties, about 100 Ph.D.s joined the federal public service annually. The number fell to 89 in 1971, and 68 in 1972.

In 1972, the overwhelming majority of Ph.D.s employed by the government had obtained their degrees in the natural sciences: 2,019 (88%). The humanities and social sciences accounted for the remaining 12%.

Table 9 shows employment sectors of Ph.D.s immediately after graduation. In the early seventies, a very small percentage of the graduates in the humanities were employed by government. The percentage in the social sciences was somewhat lighter, mainly due to economists. Few than 15% of the physical and applied scientists, who represented the largest group of Ph.D.s produced, joined the government during these years.

Table 8

Employment of Ph.D.s by Year of Appointment and Discipline in Federal Departments under the Public Service Employment Act*, 1940 to 1972.

	Before 1940	1940-1949	1950-1954	1954-1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	TOTAL
Humanities	5	14	15	14	2	1	3	4	1	3	3	4	3	11	7	7	12	109
Social Sciences																		
Economics	--	3	10	11	2	3	3	1	4	3	2	8	10	4	14	15	11	104
Sociology & Anthropology	1	1	--	1	2	1	--	1	1	1	1	3	2	2	4	2	2	25
Political Science	1	2	3	3	1	--	1	--	1	1	3	1	1	2	1	--	--	21
Psychology	--	1	2	--	--	--	--	--	1	--	1	1	2	3	3	1	--	15
Subtotal Human Sciences	**7**	**21**	**30**	**29**	**7**	**5**	**7**	**6**	**8**	**8**	**10**	**17**	**18**	**22**	**29**	**25**	**25**	**274**
Agricultural & Biological Sciences	**26**	**135**	**136**	**120**	**21**	**21**	**30**	**12**	**28**	**54**	**66**	**57**	**49**	**31**	**25**	**23**	**13**	**847**
Engineering	**1**	**4**	**1**	**9**	**3**	**5**	**4**	**2**	**6**	**9**	**9**	**6**	**9**	**7**	**8**	**4**	**5**	**92**
Physical Sciences																		
Chemistry	3	24	34	31	9	5	7	4	12	28	16	28	24	24	19	13	4	285
Geology & Related	1	20	34	24	9	10	11	4	9	15	10	20	9	14	6	10	9	215
Math. & Physics	1	9	16	9	7	2	2	5	5	5	8	8	9	13	17	6	5	127
Health Sciences																		
Dentistry	--	1	2	3	2	1	2	1	1	3	3	2	3	2	2	1	--	29
Medicine	--	16	20	32	2	5	7	6	4	8	12	5	5	6	6	3	3	140
Veterinary	10	44	61	41	7	10	7	8	13	10	14	8	18	16	8	4	4	283
Subtotal Natural Sciences	**42**	**253**	**304**	**269**	**60**	**59**	**70**	**42**	**78**	**133**	**138**	**134**	**126**	**113**	**91**	**64**	**43**	**2,019**
GRAND TOTAL	**49**	**274**	**334**	**298**	**67**	**64**	**77**	**48**	**86**	**141**	**148**	**151**	**144**	**135**	**120**	**89**	**68**	**2,293**

*** Excludes National Research Council, Defense Research Board and all crown corporations.**

Source: Adapted from a Table prepared by Dr. Valerie Sonnenfeld from unpublished Pubic Service Commission data.

Table 9

Employment Sector of Ph.D.s Immediately After Graduation from Canadian Universities by Field of Study, 1970-71 to 1974-75 (in percent)

	Humanities					Social Sciences				
	1970-71	71-72	72-73	73-74	74-75	1970-71	71-72	72-73	73-4	74-75
University Teaching	84.8	83.5	70.2	66.1	52.6	74.3	63.3	59.2	51.9	51.9
Industry	--	--	--	0.8	3.6	1.6	1.6	4.7	3.8	5.3
Government	1.9	1.7	4.9	5.5	5.8	9.3	7.6	15.4	14.6	19.0
Private Research Institutes	1.9	1.1	2.7	2.0	4.5	2.7	4.0	3.0	6.6	5.5
Other (mostly in the educational sector)	5.1	9.7	13.8	18.9	19.4	9.8	20.7	14.5	20.3	6.3
Unemployed	6.3	4.0	8.4	6.7	8.1	2.2	2.8	3.2	2.7	2.9
Total Number	**158**	**176**	**225**	**254**	**222**	**183**	**251**	**338**	**364**	**416**
Number in Postdoctoral Studies*	4	3	5	4	4	14	11	12	16	20

	Life Sciences					Physical & Applied Sciences				
	1970-71	71-72	72-73	73-74	74-75	1970-71	71-72	72-73	73-4	74-75
University Teaching	46.5	40.0	40.7	28.2	27.3	41.0	38.8	33.1	31.4	31.3
Industry	8.8	6.3	5.9	9.2	11.2	22.7	25.7	29.2	30.4	22.2
Government	22.3	18.0	18.6	30.1	21.5	14.7	12.9	13.2	14.3	14.8
Private Research Institutes	5.3	9.8	16.6	14.5	18.5	1.9	4.8	9.2	10.2	12.5
Other (mostly in the education sector)	9.4	21.0	12.2	15.3	14.1	9.1	10.9	11.3	9.1	11.7
Unemployed	7.6	4.9	5.9	2.7	7.3	10.5	6.9	4.0	4.6	7.4
Total Number	**170**	**205**	**253**	**262**	**205**	**427**	**420**	**469**	**461**	**351**
Number in Postdoctoral Studies*	126	131	160	152	99	232	249	277	244	164

* Those Ph.D. graduates who were pursuing postdoctoral studies have been excluded from the percentage distribution.

Source: Adapted from the data of the Canadian Association of Graduate Schools

Unemployment – Under-utilization

Table 9 also shows the unemployment rate of Ph.D.s by field of study. The rates indicate that only a small number are actually unemployed; a more critical question is whether they obtain positions in which their training is effectively utilized. By virtue of their education, aptitude, and motivation, Ph.D. graduates are able to displace masters and bachelors degree-holders. Under-utilization is more the issue than unemployment.

This topic has not received the attention it deserves. In recent years, one-third of the Ph.D. graduates in the natural sciences have continued their training as postdoctorals. It has been estimated that between 2,000 and 3,000 Ph.D.s are now engaged in postdoctoral studies, many of them in a kind of holding pattern, since viable employment opportunities are scarce.

Degrees

From 1960–61 to 1973–74, Canadian universities awarded 14,280 Ph.D.s, 60% of them between 1969–70 and 1973–74. The annual number increased from 300 during the early sixties to almost 2,000 in the early seventies. Table 10 shows the number of doctoral degrees awarded between 1960–61 and 1973–74 by broad field of study, and Table 11 gives the same information for selected disciplines. For the 14-year period, annual Ph.D. output in education increased from 7 to 120, and in engineering from 19 to 300. The number of Ph.D.s in mathematics rose from 10 to 150, and in psychology, from 20 to 150. It should also be remembered that in those years, a large number of Canadians obtained doctoral degrees abroad, particularly in the human sciences, and most of them returned to Canada.

During the sixties, almost three-quarters of the Ph.D.s awarded by Canadian universities were in the natural sciences, but this proportion has declined to two-thirds. The humanities and social sciences represent only 33% of Ph.D. output, although close to 60% of doctoral enrolment. This reflects a longer completion time, and a higher withdrawal rate.

Between 1964–65 and 1971–72, 10,876 new university positions, in addition to replacements, were created in the humanities and social sciences. But Canada produced only 2,627 Ph.D.s in these fields, including foreign students who returned home and graduates who might have accepted employment in industry and government. It is obvious, therefore, that there was a substantial scarcity of teachers with a Ph.D. Universities' short-term remedies were to hire landed immigrants, and lower the formal teaching qualifications. These practices had two results: 1) the proportion of foreign-born university teachers increased rapidly for a number of years, a situation which had implications for Canada's cultural identity, and 2) some who were hired might have been better suited to other activities.

Table 10

Doctoral Degrees Awarded by Field of Study, 1960-61 to 1973-74

	1960-61	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72	72-73	1973-74
Humanities	57	42	57	52	74	87	94	96	119	157	188	208	231	235
Social Sciences	41	35	39	56	56	70	78	134	157	166	229	231	291	290
Education	7	17	12	13	22	25	39	73	60	78	77	109	123	120
Subtotal Human Sciences	**105**	**94**	**108**	**121**	**152**	**182**	**211**	**303**	**336**	**401**	**494**	**548**	**645**	**645**
Percentage Human Sciences*	(34)	(29)	(26)	(25)	(27)	(26)	(27)	(30)	(30)	(29)	(30)	(32)	(33)	(33)
Agricultural and Biological Sciences	57	67	100	99	97	125	115	154	173	235	276	240	249	250
Engineering and Applied Sciences	19	20	26	46	45	83	105	103	168	188	225	261	300	300
Health Professions and Occupations	24	25	30	31	44	46	50	58	56	95	102	151	180	185
Mathematics and Physical Sciences	101	115	157	184	228	260	298	388	375	456	528	524	558	560
Subtotal Natural Sciences	**201**	**227**	**313**	**360**	**414**	**514**	**568**	**703**	**772**	**974**	**1,131**	**1,176**	**1,287**	**1,295**
Percentage Natural Sciences*	(66)	(71)	(74)	(75)	(73)	(74)	(73)	(70)	(70)	(71)	(70)	(68)	(67)	(67)
GRAND TOTAL	**306**	**321**	**421**	**481**	**566**	**696**	**779**	**1,006**	**1,180**	**1,375**	**1,625**	**1,724**	**1,932**	**1,940**

* Percentage breakdown between Human Sciences and Natural Sciences in brackets.

Source: Statistics Canada

Table 11

Doctoral Degrees Awarded by Selected Disciplines, 1960-61 to 1972-73

	Fine Arts	Economics & Business	Geography	Political Science	Psychology	Social Work	Agriculture	Medicine	Mathematics	Chemistry & Physics
1960-61	--	10	2	2	25	--	6	23	8	81
1961-62	--	5	3	1	20	1	16	25	10	93
1962-63	--	6	3	2	24	1	17	30	6	135
1963-64	2	7	3	2	35	--	17	27	21	142
1964-65	1	12	5	--	31	3	11	41	28	159
1965-66	1	14	3	5	44	--	16	40	34	177
1966-67	2	10	8	1	47	--	14	46	43	203
1967-68	--	20	10	10	82	3	15	52	49	276
1968-69	--	21	13	8	98	2	27	50	53	282
1969-70	3	15	14	18	86	2	60	87	61	332
1970-71	6	28	18	21	119	1	46	95	85	369
1971-72	6	27	22	31	109	1	52	134	97	356
1972-73	5	49	24	20	121	6	64	163	113	375
TOTAL	**26**	**224**	**128**	**121**	**841**	**20**	**361**	**813**	**608**	**2,980**

Source: Statistics Canada

Ph.D. Enrolment and Government Assistance

Numbers

Doctoral enrolment trends form the basis of the future supply of Ph.D.s. In the early seventies, about 13,000 full- and part-time students were enrolled at Canadian universities. Unlike the sixties when enrolment increased rapidly each year, between 1970–71 and 1974–75 it levelled off but increased in 1975–76. The proportion of part-time doctoral students rose for 19.7% of full-time enrolment in 1969–70 to 33.5% in 1975–76.

There was a marked shift during the early seventies from the natural sciences to the humanities and social sciences. In 1969–70, the former accounted for 51.8% of all doctoral students, but the percentage declined to 38.3% in 1975–76 (Table 12). Conversely, the humanities and social sciences increased from 48.2% to 61.7%. In absolute numbers, enrolment in the physical and applied sciences fell from 3,915 to 3,284, whereas it rose from 2,852 to 4,934 in the social sciences, and has remained constant in the humanities and life sciences.

Geographic Location

Another important feature of Canadian doctoral enrolment is the fact that more than 50% of it is in Ontario universities. The University of Toronto alone enrolled more than 20% of all doctoral students (Table 13).

Citizenship

Expansion of Canadian graduate education at the doctoral level was achieved, to a large extent, with foreign-born graduate students frequently taught by foreign-born faculty. A large percentage of full-time doctoral students are non-Canadian (Table 14). In 1972–73, landed immigrants accounted for almost one-third, while another 15% were foreign students. Table 15 shows that Americans were the largest single group from abroad, constituting 12.6% of all enrolment, with a high of 22.7% in the humanities and a low of 2.6% in engineering. In contrast, doctoral students from Asian countries made up 13.3%, with a low of 2.7% in the humanities and a high of 32.5% in engineering.

Government Assistance

A possible contributing factor for the increased number of foreign-born doctoral students was the formula financing scheme in some provinces, which allocated funds to universities on a per-capita of enrolment basis. By 1975–76, Ontario universities were receiving about $12,000 a year from the provincial government, for each Ph.D. student, in addition to tuition fees. Thus, it was in the universities' interest to expand doctoral enrolment. Moreover, there were support programs for graduate students.

Most doctoral students at Canadian universities have been supported by federal or provincial government fellowships, by teaching or research assistantships and scholarships from universities, or by student loans. It has been estimated that 50% to 75% of

Table 12

Full- and Part-time Doctoral Student Enrolment by Field of Study, 1969-70 to 1975-76

	HUMAN SCIENCES				NATURAL SCIENCES				
Academic Year	Humanities	Social Sciences	Subtotal	Annual Percentage Change	Physical & Applied Sciences	Biological Sciences & Health Professions	Subtotal	Annual Percentage Change	TOTAL
1969-70	2,779 (23.8)	2,852 (24.4)	5,631 (48.2)		3,915 (33.8)	2,101 (18.0)	6,016 (51.8)		11,649
				14.2				6.1	
1970-71	3,088 (24.1)	3,345 (26.1)	6,433 (50.2)		4,182 (32.6)	2,199 (17.2)	6,381 (49.8)		12,814
				7.9				-3.0	
1971-72	3,263 (24.6)	3,827 (28.8)	7,090 (53.4)		4,066 (30.6)	2,122 (16.0)	6,188 (46.6)		13,278
				6.5				-6.5	
1972-73	3,379 (25.4)	4,169 (31.3)	7,548 (56.7)		3,845 (28.8)	1,938 (14.5)	5,783 (43.3)		13,331
				2.9				-7.5	
1973-74	3,401 (25.9)	4,369 (33.3)	7,770 (59.2)		3,541 (27.0)	1,810 (13.8)	5,351 (40.8)		13,121
				2.1				4.2	
1974-75	3,295 (25.2)	4,640 (35.5)	7,935 (60.8)		3,352 (25.7)	1,774 (13.6)	5,126 (39.3)		13,061
				3.6				-0.3	
1975-76	3,288 (24.7)	4,934 (37.0)	8,222 (61.7)		3,284 (24.6)	1,826 (13.7)	5,110 (38.3)		13,332

* Figures in brackets indicate the percentage by field of study.

Source: Adapted from the Canadian Association of Graduate Schools data.

Table 13

Full- and Part-time Doctoral Enrolment at Five Selected Universities,* 1968-69 to 1975-76

Year	Alberta	British Columbia	McGill	Montreal	Toronto	Sub-Total	Other 22 Universities	TOTAL
1968-69	808	882	1,016	763	1,817	5,286	4,318	9,604
	(8.4)	(9.2)	(10.6)	(7.9)	(18.9)	(55.0)	(45.0)	
1969-70	961	1,015	1,327	883	2,290	6,476	5,201	11,677
	(8.2)	(8.7)	(11.4)	(7.6)	(19.6)	(55.5)	(44.5)	
1970-71	1,074	1,079	1,325	973	2,550	7,001	5,813	12,814
	(8.4)	(8.4)	(10.3)	(7.6)	(19.9)	(54.6)	(45.4)	
1971-72	1,077	1,061	1,314	1,000	2,647	7,099	6,169	13,268
	(8.1)	(8.0)	(9.9)	(7.5)	(20.0)	(53.5)	(46.5)	
1972-73	1,019	1,024	1,239	1,116	2,700	7,098	6,233	13,331
	(7.6)	(7.7)	(9.3)	(8.4)	(20.3)	(53.2)	(46.8)	
1973-74	942	948	1,202	1,174	2,724	6,990	6,131	13,121
	(7.2)	(7.2)	(9.2)	(9.0)	(20.8)	(53.3)	(46.7)	
1974-75	910	891	1,128	1,174	2,854	6,957	6,104	13,061
	(7.0)	(6.8)	(8.6)	(9.0)	(21.9)	(53.3)	(46.7)	
1975-76	895	836	1,082	1,372	2,821	7,006	6,326	13,332
	(6.7)	(6.3)	(8.1)	(10.3)	(21.2)	(52.6)	(47.4)	

* Figures in brackets indicate percentage distribution
Source: Adapted from the Canadian Association of Graduate Schools data.

doctoral students in the physical and applied sciences have obtained funding through National Research Council grants. (The exact number is difficult to determine because National Research Council support could consist of either direct fellowships to students, or research grants provided to universities or individual faculty members, which enable them to hire doctoral students as research assistants.) Consequently, in most of the natural sciences doctoral students have experienced little difficulty obtaining financial support to cover their living and transportation expenses. By contrast, only one-third of the full-time doctoral students in the humanities and social sciences have been supported by the Canada Council. Others have received fellowships from the provinces, or have benefited from the federal Canada Student Loan Plan.

The Canada Council increased the number of fellowships in the humanities and social sciences from 426 in 1965–66 to a high of 2,456 in 1970–71; they declined to 1,387 by 1975–76. Table 16 shows the number of Canada Council doctoral fellowships by discipline

Table 14

Citizenship and Immigration Status of Full-time Masters and Ph.D. Students by Field of Study, 1972-1973 (in percent)

Field of Study	Canadian Citizen		Landed Immigrant		Foreign Students		Non-Canadian Status (not reported)		Total Number*	
	Masters	Ph.D.	Masters	Ph.D.	Masters	Ph.D.	Masters	Ph.D.	Masters	Ph.D.
Education	81.1	69.9	12.1	20.7	6.3	8.6	0.7	0.8	1,468	618
Fine & Applied Arts	80.2	75.9	14.3	22.2	3.6	1.9	--	--	217	54
Humanities	73.4	56.4	12.6	30.0	12.9	10.9	1.1	2.9	3,114	1,777
Social Sciences	77.5	59.9	11.6	27.9	9.6	11.0	1.3	1.2	5,826	1,919
Agricultural & Biological Sciences	76.2	53.0	12.4	31.6	8.8	12.8	1.6	2.6	969	830
Engineering	51.5	33.8	28.2	43.3	18.8	19.7	1.5	3.2	1,759	1,043
Health Professions & Occupations	75.5	61.3	19.0	29.6	5.3	7.9	0.2	1.2	485	432
Mathematics & Physical Sciences	64.6	45.4	20.6	40.9	12.7	12.3	2.1	1.4	1,598	1,852
TOTAL	**72.6**	**53.0**	**15.1**	**32.9**	**11.0**	**12.1**	**1.3**	**2.0**	**15,114**	**8,395**

* The legal status of graduate students was available for only about 80% of the masters and doctoral students.
Source: Statistics Canada, unpublished data.

Table 15

Citizenship of Full-time Ph.D. Students by Country and Field of Study, 1972-1973 (in percent)

Field of Study	Canada	United States	United Kingdom	France & Other European	Caribbean	Central & South America	Africa	South Pacific	Asia	Total Number
Education	70.5	10.8	3.6	2.1	0.8	0.2	2.4	3.9	5.7	614
Humanities	57.2	22.7	6.8	5.7	1.0	0.6	1.4	1.9	2.7	1,751
Social Sciences	60.9	15.9	6.2	4.9	0.5	0.3	2.7	1.9	6.8	1,888
Agriculture and Biological Sciences	53.9	12.0	8.2	4.2	0.7	0.6	2.7	2.6	15.2	817
Engineering	34.7	2.6	4.2	10.1	0.3	2.0	11.8	1.8	32.5	1,017
Health Professions and Occupations	61.6	4.8	3.6	7.4	1.4	1.5	1.1	1.7	17.0	927
Mathematics and Physical Sciences	46.8	8.0	9.6	7.0	0.6	1.5	2.0	2.8	21.7	1,798
TOTAL	**53.8**	**12.6**	**6.9**	**5.9**	**0.7**	**0.9**	**3.5**	**2.4**	**13.3**	**8,442**

* The information was available for about 80% of the full-time doctoral students.

Source: Statistics Canada, unpublished data.

Table 16

Canada Council Doctoral Fellowship Holders by Discipline, 1965-66 to 1975-76

	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
Administrative Studies[1]	--	--	--	--	23	26	31	24	18	24	12
Business Administration	--	--	--	--	59	64	68	47	36	29	21
Anthropology (Archaeology)	9	36	55	79	86	99	96	90	75	76	74
Economics	53	125	181	234	207	215	182	135	113	95	79
Education[2]	---	--	--	--	58	92	93	137	157	144	152
Fine Arts	19	34	53	59	65	77	88	71	58	64	48
Geography & Demography	13	31	47	69	54	63	56	46	36	35	30
History	68	132	230	303	272	257	261	214	175	149	125
Classics	13	42	45	48	44	43	33	22	18	19	18
English	52	113	211	321	323	313	286	204	173	136	124
French	41	68	115	152	144	138	112	91	74	60	49
German	6	9	27	40	36	34	29	19	18	21	19
Other Foreign Languages	10	20	39	56	76	79	86	69	59	54	56
Law	3	14	27	51	48	40	26	34	34	31	34
Linguistics	4	26	41	69	82	68	66	44	42	33	35
Mathematics	2	2	12	16	36	44	44	32	27	19	14
Philosophy	32	84	151	219	190	183	170	117	100	81	86
Political Science	37	99	154	184	183	194	183	153	133	122	103
Psychology	25	29	51	110	122	167	200	183	175	170	173
Religious Studies[3]	--	--	--	--	50	55	58	43	40	31	26
Social Work	--	--	--	--	2	4	5	3	3	--	1
Sociology	39	85	115	176	163	165	166	133	120	102	78
Other[4]	--	--	--	--	45	36	56	44	38	39	30
TOTAL	**426**	**949**	**1,554**	**2,183**	**2,368**	**2,456**	**2,395**	**1,955**	**1,722**	**1,534**	**1,387**

* Between 1957-58 and 1964-65, a total of only 1,318 predoctoral fellowships were granted: 97 in 1957-58, 110 in 1958-59; 121 in 1959-60; 133 in 1960-61; 169 in 1961-1962; 184 in 1962-63; 216 in 1963-1964; 288 in 1964-1965.

[1] Prior to 1969-70, Public Administration was not included in Political Science and Business; and Administration often under Economics

[2] Prior to 1969-70, Education was included in Psychology.

[3] Prior to 1969-70, Religious Studies were included in Philosophy.

[4] This category includes areas such as Urban and Regional Studies, Communication Studies, Criminology, Information Sciences, and Interdisciplinary subjects.

Source: Annual Reports of the Canada Council between 1965–66 and 1975–76. An estimated one-third of the full-time doctoral students at Canadian universities were benefiting each year from the Council's Program.

The federal Canada Student Loan Plan has made it possible for doctoral students to borrow interest-free $1,000 to $1,800 annually (up to a present maximum of $9,800), depending on the province (excluding Quebec), and the year the loan was granted. The percentage who have done so is comparatively low. As an illustration, during the late sixties and early seventies, there were about 10,000 full-time doctoral students at Canadian universities each year, out of which only a few hundred took advantage of the Canada Student Loan Plan. Table 17 gives the number of Canada Student Loan Plan certificates issued, by province: a total of 373 in 1964–65 which increased to 3,238 in 1974–75. The majority, 3 035, went to Ontario residents. The number of certificates in Ontario had risen from 504 in 1971–72 to 2,177 the next year, reflecting a change in the Ontario Student Assistance Program so that it consisted of an $800 loan and a grant of up to $600.

The Canada Student Loan Plan also offered financial assistance for doctoral studies abroad. In 1967–68, of the 593 recipients, 29.7% were studying in the United States, 10.6% in the United Kingdom, and 3% in other countries (Table 18). Six years later, in 1973–74, the number of loan recipients had increased to 2,656. However, of the 2,451 studying in Canada, 2,275 were in Ontario. Studies abroad had declined: 4.2% in the United States, 2.2% in the United Kingdom, and 1.3% in other countries. Since most doctoral students receive financial assistance from universities and federal and provincial sources, their main economic contribution to their education consists of foregone income.

Doctoral Programs

Historical Development

At present, 34 universities offer Ph.D. programs, most of which were created during the sixties and early seventies. This is a considerable change from 1944–45 when only five Canadian universities had doctoral programs (Table 19).[6] During the fifties there was little expansion, and fewer than 300 Ph.Ds were granted each year, most of them in the natural sciences.

The sixties was an era of dramatic increase in the number of doctoral programs. According to the Handbook of the Association of Universities and Colleges, in 1970, 851 different doctoral programs were in operation at 30 universities. By 1974 the number had increased to 1,146 (in addition to 2,000 masters programs), many of which have small enrolments (Table 20). Every province but Prince Edward Island, developed its own programs, without national planning or co-ordination.

Thus, 26 universities have doctoral programs in chemistry, 18 in English literature, 19 in history, 15 in geography, and 12 in sociology. Considering the many options in each discipline, the number of courses is very large. This is illustrated by a subject like English Literature in which a student can specialize in areas ranging from Medieval studies to modern drama or poetry.

Table 17

Canada Student Loan Plan Certificates for Doctoral Students by Province, 1964-65 to 1974-75

	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75
Newfoundland	2	5	5	8	11	11	7	7	10	5	3
Prince Edward Island	1	3	3	1	2	--	2	6	6	2	3
Nova Scotia	23	19	9	24	22	32	29	40	27	45	20
New Brunswick	8	13	19	26	12	18	11	10	10	6	10
Ontario	244	208	127	258	162	185	348	504	2,177	2,472	3,035
Manitoba	14	20	34	32	24	35	35	32	36	28	55
Saskatchewan	9	23	23	28	24	30	29	16	28	10	17
Alberta	22	51	71	83	106	132	115	84	63	23	31
British Columbia	50	98	112	133	91	95	118	72	50	65	64
Total	**373**	**440**	**403**	**593**	**454**	**538**	**694**	**771**	**2,407**	**2,656**	**3,238**

Note: The province of Quebec does not participate in the Canada Student Loan Plan, but has its own student assistance program.

Source: Department of Finance

Table 18

Canada Student Loan Plan Doctoral Student Recipients by Province or Country of Study, 1964-65 to 1974-75

	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75
Newfoundland	--	1	1	1	--	1	--	2	4	7	12
Prince Edward Island	--	--	1	--	--	--	--	--	1	--	--
Nova Scotia	20	12	7	10	8	13	11	19	21	38	13
New Brunswick	2	10	8	9	5	6	4	6	5	5	4
Quebec*	10	11	12	10	9	12	9	11	38	51	88
Ontario	208	131	81	180	105	125	295	392	1,992	2,275	2,739
Manitoba	2	5	9	10	5	12	14	15	22	7	46
Saskatchewan	5	5	7	12	2	3	7	7	8	5	8
Alberta	13	24	32	46	63	80	70	53	61	31	39
British Columbia	6	48	51	58	32	34	69	41	27	32	19
Sub-Total - CANADA	**266**	**247**	**209**	**336**	**229**	**286**	**479**	**546**	**2,179**	**2,451**	**2,968**
United States	64	150	143	176	157	169	140	141	129	112	149
United Kingdom	17	29	32	63	52	65	60	62	65	59	61
Other	6	14	19	18	16	18	15	22	34	34	60
Total	**373**	**440**	**403**	**593**	**454**	**538**	**694**	**771**	**2,407**	**2,656**	**3,238**

* Quebec is not participating in the Canada Student Loan Plan
Source: Department of Finance

Table 19

Number of Canadian Universities Offering Master's and Doctoral Degree Programs, 1944-45 to 1974-75

	Master's degree	Doctor of Philosophy
1944-45	17	5
1946-47	18	7
1950-51	22	13
1954-55	23	13
1958-59	28	16
1962-63	31	19
1966-67	38	24
1970-71	45	30
1974-75	52	34

Source: Association of Universities and Colleges of Canada

Chemistry, too, is divided into many sub-groups within the major branches. Although some specialties are in demand, a substantial number of doctorates are still produced in other disciplines where demand is subsiding. Therefore, shortages and surpluses can exist within one discipline. Since, for economic, political and structural reasons, Canada's chemical industry will not expand substantially, the question of how many universities should offer doctoral programs in chemistry has been raised.

A similar situation seems to have developed in engineering. Altogether, there are 216 different doctoral programs, including 21 in chemical engineering, 17 in civil, 20 in electrical and 18 in mechanical. Because Canadian industry has not hired many engineering Ph.Ds, positions are scarce; for lack of employment opportunities, some students have undertaken post-doctoral studies. In the past, most Ph.Ds were employed in the university sector and others joined the government. The number of openings in these areas has diminished in recent years, and indications are that future job prospects are less than promising.

The present saturation of universities and government is particularly critical for humanities and most social science Ph.Ds; up to 90% of them were traditionally employed in these sectors, although actual numbers are small. Yet, in 1974–75, there were 131 different doctoral programs in the humanities and 282 in the social sciences.

Table 20

Number of Doctoral Programs at Canadian Universities by Discipline, 1974-75

Discipline	Number
Humanities	
Fine and Applied Arts	18
Classics	5
History	30
English	16
French	9
German	8
Spanish	5
Other Modern Languages	11
Philosophy	21
Religious Studies	26
Other humanities	12
Sub-Total Humanities	**131**
Social Sciences	
Archaeology	7
Anthropology	8
Area Studies	45
Commerce and Business Administration	23
Economics	19
Education	84
Geography	27
Law	6
Political Science	19
Psychology	27
Social Work	4
Sociology	13
Sub-Total Social Sciences	**282**
Biological Sciences	
Agriculture	67
Biology	62
Botany	26
Household Science and related	12
Veterinary Medicine and Science	15
Zoology	8
Other Biological Sciences	14
Sub-Total Biological Sciences	**204**

Table 20 (cont'd)

Discipline	Number
Applied Sciences	
Architecture	1
Chemical Engineering	21
Civil Engineering	17
Electrical Engineering	20
Mechanical Engineering	18
Mining Engineering	5
Forestry	33
Other Engineering and Applied Sciences	101
Sub-Total Applied Sciences	**216**
Medical Sciences	
Dentistry	6
Medicine	84
Pharmacy	10
Other Medical Sciences	30
Sub-Total Medical Sciences	**130**
Physical Sciences	
Mathematics	25
Chemistry	26
Geology and related	15
Physics	46
Other Physical Sciences	5
Sub-total Physical Sciences	**117**
GRAND TOTAL	**1,146**

The Ratio of Degrees to Enrolment

As a measure of output, the ratio of Ph.Ds granted to total enrolment for a six-year period has been estimated by field of study. To overcome the effect of yearly fluctuations, these calculations were based on a six-year average. Table 21 shows that about 20% of Ph.D. students have graduated each year in the natural sciences, compared with only 6.7% in the humanities and 7.5% in the social sciences.

In chemistry, for example, 23.3% received doctorates each year compared with 5.2% in political science and 5.5% in sociology (Table 22). Expressed differently, it would take a cohort of 100 chemistry doctoral students slightly more than four years to graduate, whereas similar cohorts in political science and sociology would take about 20 years. In absolute numbers, 204 Ph.Ds in chemistry were awarded each year between 1969–70 and 1975–76, but only 23 in political science and 20 in sociology.

Table 21

Ratio between Ph.D. Enrolment and Ph.D. Awards by Field of Study, 1969-70 to 1974-75 (in percent)

	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	Six Year Average	Total Degrees Granted
Education	11.6	8.3	11.0	9.9	10.8	7.8	9.9	599
Humanities	4.8	4.8	6.2	7.7	7.9	8.9	6.7	1,248
Social Sciences	7.4	6.2	7.1	7.2	8.6	8.5	7.5	1,355
Biological Sciences	12.9	16.6	17.2	20.3	22.2	20.4	18.3	1,117
Applied Sciences	12.0	16.6	16.3	20.6	23.2	23.3	18.7	1,455
Health Occupations	15.3	17.6	21.0	25.0	28.1	23.0	21.7	1,176
Physical Sciences	15.1	15.3	20.1	19.6	24.3	21.3	19.3	2,933
All Fields	**10.5**	**11.0**	**12.7**	**13.4**	**15.0**	**13.8**	**12.7**	**9,883**

Source: Derived from the Canadian Association of Graduate Schools' data.

A number of illustrations are of interest. Cumulatively, for a seven year period, there were 4,797 Ph.D. students in physics and 958 degrees were granted 137 (20.0%) each year. Enrolment in English was greater — 5,630 students but only 409 Ph.Ds or 58 (7.3%) a year were granted.

The ratio of enrolment to Ph.D. awards in most of the humanities and social sciences requires thoughtful analysis. More careful selection of students might lessen the drop-out rate (50%) and reduce the length of time for completion of a doctorate. Although the formal requirement from masters or equivalent standing to a Ph.D. is two to three years, the normal time is five years. By contrast, in most sciences the actual length of study is three years, with a withdrawal rate of less than 25%.

Differences in Ph.D. productivity have been attributed to the less formal structure of the humanities and social sciences, greater emphasis on the dissertation, and the newness of many doctoral programs. Whatever the reason, there is a need for change. From a student's point of view, an indefinite period of study is frustrating and costly, and from society's vantage point, it is also expensive. As previously mentioned, most provinces pay universities more than $ 10,000 annually for each Ph.D. student. But the small number of doctorates conferred in most of the humanities and social sciences in relation to Ph.D. enrolment in those disciplines may have been a blessing in disguise for the seventies. Otherwise, the number of Ph.Ds seeking employment would have been even larger.

Table 22

Ratio between Ph.D. Enrolment and Ph.D. Awards by Selected Disciplines, 1969-70 to 1975-76

	Seven Years Total Enrolment	Seven Years Total Degrees Granted	Percentage	Average Annual Number of Degrees Granted
Classics	596	54	9.1	8
History	4,503	350	7.8	50
English	5,630	409	7.3	58
French	2,657	164	6.2	23
Modern Languages & Literature	2,327	159	6.8	23
Philosophy	3,247	254	7.8	36
Religious Studies	1,419	117	8.2	17
Anthropology & Archaeology	1,379	78	5.6	11
Commerce, Business Administration	646	55	8.5	8
Economics	2,395	150	6.3	21
Geography	1,744	168	9.6	24
Law	459	45	9.8	6
Political Science	3,093	161	5.2	23
Psychology	7,635	803	10.5	115
Sociology	2,570	141	5.5	20
Medicine	5,015	1,051	21.0	150
Pharmacy	823	193	23.5	28
Mathematics	4,479	664	14.8	95
Chemistry	6,111	1,425	23.3	204
Geology	1,694	256	15.1	37
Physics	4,797	958	20.0	137
ALL DISCIPLINES*	**90,669**	**11,708**	**12.9**	**1,673**

* Includes other disciplines not identified.

Source: Derived from the Canadian Association of Graduate Schools' data.

The Irregular Supply of Ph.D.s

A cycle of shortage and surplus in the supply of Ph.D.s appears to be developing in some disciplines. In 1973–74 and 1974–75, fewer new doctoral students registered, than there were Ph.D.s granted. Only 1,545 new doctoral students enrolled in 1973–74, whereas 1,940 degrees were awarded. The figures for 1974–75 were 1,793 new students and 1,900 Ph.D.s granted (Table 23). Consequently, taking the drop-out rate for new students into account, there will be a substantial decline in the number of degrees conferred three to five years hence. Chemistry exemplifies this boom or bust cycle. For seven years Canadian universities awarded an average of 204 Ph.D.s, but in 1973–74, only 57 students enrolled: 103 in 1974–75; and 83 in 1975–76. Thus a substantial decline in Ph.D.s is likely in three years. However, in 1975–76 the number of new doctoral students has increased to 2,306 or 17.3% of the total doctoral enrolment with considerable variations by discipline.

To this point, discussion has dwelt only on supply. Graduate students in chemistry, as in many other disciplines, have reacted to current diminishing employment opportunities by not continuing to the doctoral level, although information about the demand in three to five years is imperfect. This may be a wise course of action for individual students, but collectively, it creates recurring imbalances.

Universities might consider establishing ratios of the number of new Ph.D. students to the total enrolled. In 1973–74, this ratio was 1 1.8%, 13.7% in 1975–76 for all fields, but varied among disciplines. The problem is to determine the ideal ratio, taking both supply and demand into consideration. The next section simulates anticipated supply and demand for Ph.D.s for university teaching from 1977–78 to 1981–82.

Ph.D. Supply and Demand in the University Sector

The demand for Ph.D.s in the next five years is difficult to predict. It has been estimated that only 1.3% to 1.5% of the present 35,000 Ph.D. positions will have to be replaced each year fewer than 500 annually for the next few years. This means that one out of four of the 2,000 new Ph.D.s produced each year will be absorbed as replacements for Ph.D. holders who retire, die, or withdraw for health reasons.

Historically, education and government have employed about 85% of the Ph.D.s in Canada. The present economic climate indicates that those two sectors will utilize a much reduced number of Ph.D.s. Austerity measures instituted by the federal and provincial governments will decrease employment opportunities in the public sector. The combination of financial constraints and demographic trends have the same effect on university teaching positions. Demographic patterns indicate that in a few years, the source population for postsecondary students (18–24 years old) will drop from 3.3 million to 2.7 million, and universities will have to anticipate a decline in enrolment, provided that the participation rate for postsecondary education does not change markedly. A model, described in Appendices A and B,* simulates the supply and demand for Ph.D.s in universities. After adjustments for other employment possibilities the balance is considered a potential surplus.

Table 23

New Doctoral Students as a Percentage of Doctoral Enrolment, 1973-74 to 1975-76

	1973-74			1974-75			1975-76		
	Enrolment*	New Students	%	Enrolment*	New Students	%	Enrolment*	New Students	%
EDUCATION	**1,205**	**139**	**11.5**	**1,298**	**145**	**11.2**	**1,335**	**264**	**19.8**
Fine Arts	92	8	8.7	92	3	3.3	147	18	12.2
Classics	81	7	8.6	65	6	9.2	68	10	14.7
History	677	59	8.7	657	71	10.8	645	92	14.3
English	875	98	11.2	853	113	13.2	816	152	18.6
French	362	24	6.6	344	34	9.9	357	37	10.4
Library Science	10	5	50.0	7	1	14.3	10	2	20.0
Modern Languages and Literature	442	30	6.8	404	31	7.7	400	46	11.5
Philosophy	470	40	8.5	460	61	13.3	453	56	12.4
Religious Studies	204	14	6.9	197	15	7.6	193	21	10.9
Other	20	5	25.0	32	3	9.4	75	6	8.0
HUMANITIES (total)	**3,233**	**290**	**8.4**	**3,111**	**338**	**10.9**	**3,164**	**440**	**13.9**
Anthropology & Archaeology	198	19	9.6	214	30	14.0	258	23	8.9
Area Studies	198	14	7.1	210	29	13.8	178	17	9.6
Commerce, Business Admin.	99	9	9.1	112	27	24.1	114	29	25.4
Economics	377	61	16.2	404	82	20.3	429	97	22.6
Geography	244	39	16.0	250	33	13.2	229	55	24.0
Law	60	2	3.3	67	11	16.4	63	7	11.1
Political Science	486	74	15.2	509	82	16.1	522	78	14.9
Psychology	1,153	139	12.1	1,217	195	16.0	1,326	294	22.2

Table 23 (cont'd)

	1973-74			1974-75			1975-76		
	Enrolment*	New Students	%	Enrolment*	New Students	%	Enrolment*	New Students	%
Social Work	37	7	18.9	40	5	12.5	45	7	15.6
Sociology	421	51	12.1	421	61	14.5	449	77	17.1
Other	50	9	18.0	73	21	28.8	0	26	--
SOCIAL SCIENCES (total)	**3,323**	**424**	**12.8**	**3,517**	**576**	**16.4**	**3,613**	**710**	**19.7**
BIOLOGICAL SCIENCES	**923**	**139**	**15.1**	**1,000**	**142**	**14.2**	**1,087**	**224**	**20.6**
APPLIED SCIENCES	**1,263**	**150**	**11.9**	**1,158**	**132**	**11.8**	**1,267**	**165**	**13.0**
Dentistry	10	1	10.0	12	1	8.3	12	2	16.7
Medicine	695	101	14.5	644	110	17.1	675	144	21.3
Pharmacy	101	9	8.9	91	14	15.4	91	25	27.5
Other	40	5	45.5	27	6	22.2	30	7	23.3
HEALTH SCIENCES	**846**	**116**	**13.7**	**774**	**131**	**16.9**	**808**	**178**	**22.0**
Mathematics	621	102	16.4	571	85	14.9	580	113	19.5
Chemistry	760	57	7.5	716	103	14.4	663	83	12.5
Geology	255	50	19.6	260	45	17.3	277	45	16.2
Physics	641	66	10.3	589	55	9.3	512	64	12.5
Other	51	12	23.5	67	36	53.7	26	20	76.9
PHYSICAL SCIENCES	**2,328**	**287**	**12.3**	**2,203**	**324**	**14.6**	**2,058**	**325**	**15.8**
TOTAL	**13,121**	**1,545**	**11.8**	**13,061**	**1,793**	**13.7**	**13,332**	**2,306**	**17.3**

Source: Derived from the Canadian Association of Graduate Schools' data.

* Both full and part-time doctoral students.

The model treats each of the 42 discipline categories separately, and assumes that there is no substitutability among them. For example, a deficit in dentistry cannot be filled by a surplus in pharmacy. Tables 24 and 25 summarize the supply and demand pattern of Ph.D.s by discipline for university teaching, and serve as a basis for a five-year projection.

For most disciplines, the surplus is small in absolute numbers, but large in percentage terms. For example, there is a supply of 12 Ph.D.s in classics and a demand for 6, creating a surplus of 6 persons, but this means 50.0% under-utilization.

Between 1977–78 and 1981–82 there will be a cumulative surplus of 3,230 Ph.D.s, 1,780 in the natural sciences and 1,250 in the humanities and social sciences (Table 26). Only in the health sciences do supply and demand seem to balance more. Nevertheless, if some of the assumptions underlying the model change, the situation could be different. For example, universities simply might not hire new faculty although an increase in enrolment over the next few years is likely. Or, to economize, they might fill positions that become vacant through retirement and death with graduate students and part-time teachers. This is appealing for universities whose financial resources have been reduced in relative terms. It is even more attractive in view of the fact that as they acquire seniority, faculty move into higher ranks with higher salaries, compared to those of lecturers and assistant professors. As another economy measure, provincial governments and universities might consider a slight increase in the student-teacher ratio which would mean a substantial saving of positions each year.

The future prospect is that few teachers will be employed in relation to the total. This could have serious implications for the quality of university education in Canada. During the sixties, universities had to rely on less than fully-trained personnel to meet the growing demand, many of whom are still employed. Now when there is an adequate supply of Ph.D.s, even the best experience difficulty obtaining university positions. Without suitable employment it is difficult for them to keep abreast of research in their field, and there is a danger that their training may become obsolete.

The supply of Ph.D.s, at least for the next five years, can be projected more accurately because doctoral students now enrolled will still be in the system. Nevertheless, particularly at the discipline level, the figures are meant to indicate the magnitude of the problem rather than to predict precise numerical values. From a policy point of view this exercise should be regarded as only one type of analysis, which needs to be supplemented by information from other sources and judgmental considerations.

This simulation seems to indicate that the employment opportunities in the university sector for the next five years will be limited and many Ph.D. holders will have to pursue other career alternatives. This scenario does not only provide challenges for the individual Ph.D. recipient, but also to the universities as well as government and industry. They will have to develop new avenues of employment for this group of highly-skilled and motivated young Ph.D. holders.[7]

Table 24

Supply of Ph.D.s for University Teaching by Discipline, 1976-77

		Less Foreign Students		Withdrawal Rate		Length of Study until Graduation	
	Ph.D. enrolment	in percent	balance	in percent	balance	years	Degree granted each year
Humanities							
Fine & Applied Arts	147	5	140	60	56	5	11
Classics	68	10	61	30	43	5	9
History	605	10	544	40	326	5	65
English	816	10	734	55	330	5	66
French	357	10	321	55	144	5	29
Other Modern Languages and Linguistics	472	10	431	60	172	5	34
Philosophy	453	10	408	45	224	5	45
Religious Studies	193	10	174	45	96	5	19
Others	50	10	45	45	25	5	5
Sub-total Humanities	**3,161**		**2,858**		**1,416**	**5**	**283**
Social Sciences							
Anthropology	218	10	196	50	98	5	20
Archaeology	40	10	36	50	18	5	4
Area Studies	210	10	189	50	94	5	19
Business Administration	114	10	103	50	51	5	10
Economics	429	10	386	50	193	5	39
Education	1,335	5	1,268	60	507	5	101
Geography	229	10	206	40	124	5	25
Law	63	10	57	50	29	5	6
Political Science	522	10	470	65	164	5	33
Psychology	1,326	10	1,193	45	656	5	131
Social Work	45	10	41	50	21	5	4
Sociology	449	10	404	65	141	5	28
Other	113	10	102	50	51	5	10
Sub-total Social Sciences	**5,093**		**4,651**		**2,147**	**5**	**430**
Applied Sciences							
Architecture	41	15	37	50	17	3	6
Chemical Engineering	187	15	159	15	135	3	45
Civil Engineering	195	15	166	15	141	3	47
Electrical Engineering	322	15	274	15	233	3	78

Table 24 (cont'd)

Supply of Ph.D.s for University Teaching by Discipline, 1976-77

		Less Foreign Students		Withdrawal Rate		Length of Study until Graduation	
	Ph.D. enrolment	in percent	balance	in percent	balance	years	Degree granted each year
Mechanical Engineering	177	15	150	15	128	3	43
Mining	111	15	94	15	80	3	27
Forestry	54	15	46	40	28	3	9
Other	134	15	114	50	57	3	19
Sub-Total Applied Sciences	**1,221**		**1,040**		**819**	**3**	**274**
Biological Sciences							
Agriculture	94	10	85	20	68	3	23
Biology	310	10	279	50	139	3	46
Botany	200	10	180	10	162	3	54
Veterinary Medicine	74	10	67	20	54	3	18
Zoology	240	10	216	20	173	3	58
Other	70	10	63	20	50	3	17
Sub-Total Biological Sciences	**988**		**890**		**646**	**3**	**216**
Health Sciences							
Dentistry	12	10	11	20	9	3	3
Medicine	668	10	601	25	451	3	150
Pharmacy	91	10	82	20	66	3	22
Other	40	10	36	20	29	3	10
Sub-Total Health Sciences	**811**		**730**		**555**	**3**	**185**
Physical Sciences							
Mathematics and related	570	15	484	35	315	3	105
Chemistry	663	15	564	15	479	3	160
Geology	277	15	235	50	117	3	39
Physics	512	15	435	30	305	3	102
Other	36	15	31	50	15	3	5
Sub-Total Physical Sciences	**2,058**		**1,749**		**1,231**	**3**	**411**
TOTAL	**13,344**		**11,918**		**6,814**		**1,799**

Table 24 (cont'd)

Supply of Ph.D.s for University Teaching by Discipline, 1976-77

	Returning Canadians				Total Canadian & foreign	less already employed		university teaching	
	United States	United Kingdom	other countries	sub-total		in percent	balance	in percent	balance
Humanities									
Fine & Applied Arts	5	2	4	11	22	15	19	90	17
Classics	2	3	1	6	15	15	13	90	12
History	8	4	4	16	81	15	69	90	62
English	6	5	2	13	79	15	67	90	60
French	2	1	4	7	36	15	31	90	28
Other modern Languages and linguistics	3	1	4	8	42	15	36	90	32
Philosophy	5	6	8	19	64	15	54	90	49
Religious Studies	1	1	2	4	23	15	20	90	18
Others	2	1	1	4	9	15	8	90	7
Sub-Total Humanities	**34**	**24**	**30**	**88**	**371**	**15**	**317**		**285**
Social Sciences									
Anthropology	--	--	--	20	20	15	17	75	13
Archaeology	3	2	2	7	11	15	9	75	8
Area Studies	3	2	1	6	25	15	21	75	16
Business Administration	9	0	0	9	19	15	16	75	12
Economics	10	7	2	19	58	15	47	50	24
Education	15	3	2	20	121	15	103	50	52
Geography	3	2	3	8	33	15	28	75	21
Law	2	2	1	5	11	15	9	50	4
Political Science	5	5	6	16	49	15	42	75	32
Psychology	15	3	2	20	151	15	128	50	64
Social Work	1	1	1	3	7	15	6	75	4
Sociology	5	4	4	13	41	15	35	75	26
Other	3	1	1	5	15	15	13	75	10
Sub-Total Social Sciences	**74**	**32**	**25**	**131**	**561**		**474**		**286**
Applied Sciences									
Architecture	1	2	3	6	12	5	11	50	6
Chemical Engineering	3	3	0	6	51	5	48	50	24
Civil Engineering	3	3	0	6	53	5	50	50	25

Table 24 (cont'd)

Supply of Ph.D.s for University Teaching by Discipline, 1976-77

	Returning Canadians				Total Canadian & foreign	less already employed		university teaching	
	United States	United Kingdom	other countries	sub-total		in percent	balance	in percent	balance
Electrical Engineering	5	5	1	11	89	5	85	50	42
Mechanical Engineering	3	3	0	6	49	5	47	50	24
Mining	3	2	0	5	32	5	30	50	15
Forestry	1	1	1	3	12	5	11	50	6
Other	2	3	3	8	27	5	26	50	13
Sub-Total Applied Sciences	**21**	**22**	**8**	**51**	**325**		**308**		**155**
Biological Sciences									
Agriculture	6	1	1	8	31	5	29	50	14
Biology	5	3	1	9	55	5	52	50	26
Botany	8	3	1	12	66	5	63	50	32
Veterinary Medicine	3	1	1	5	23	5	22	50	11
Zoology	8	3	1	12	70	5	66	50	33
Other	2	3	1	6	23	5	22	50	11
Sub-Total Biological Sciences	**32**	**14**	**6**	**52**	**268**		**254**		**127**
Health Sciences									
Dentistry	1	1	1	3	6	5	6	50	3
Medicine	7	1	1	9	159	5	151	50	76
Pharmacy	2	1	1	4	26	5	25	50	12
Other	2	0	0	2	12	5	11	50	6
Sub-Total Health Sciences	**12**	**3**	**3**	**18**	**203**		**193**		**97**
Physical Sciences									
Mathematics & related	12	2	2	16	121	5	115	50	58
Chemistry	10	5	5	20	180	5	171	40	86
Geology	8	3	2	13	52	5	49	50	24
Physics	13	6	10	29	131	5	124	50	62
Other	5	2	2	9	14	5	13	50	6
Sub-Total Physical Sciences	**48**	**18**	**21**	**87**	**498**		**472**		**236**
TOTAL	221	113	93	427	2,226		2,018		1,186

Table 25

Demand and Supply of University Teachers with a Doctorate Degree, 1977–78

	New Growth	Replacement	New Total	Proportion with Doctorate	Effective Demand	Potential Supply	Surplus (+) Demand (–)	Percentage under-utilized
Education	44	29	73	50	40	52	+ 12	23.1
Fine and Applied Arts	18	12	30	50	19	17	– 2	
Classics	4	3	7	80	6	12	+ 6	50.0
History	16	10	26	30	21	62	+ 41	66.1
English	21	14	35	80	28	60	+ 32	53.3
French	12	8	20	80	16	28	+ 12	42.8
Other Modern Languages	15	11	26	80	21	32	+ 11	34.4
Philosophy	11	7	18	80	14	49	+ 35	71.4
Religious Studies	9	6	15	80	12	18	+ 6	33.3
Sub-Total Humanities	**88**	**59**	**147**	—	**118**	**261**	**+ 143**	**54.8**
Anthropology	5	4	9	75	7	21	+ 14	66.7
Area Studies	2	1	3	75	2	16	+ 14	87.5
Commerce, Business Administration	18	12	30	75	22	12	– 10	
Economics	14	10	24	75	24	32	+ 8	25.0
Geography	9	6	15	75	11	21	+ 10	47.6
Law	8	5	13	75	10	4	– 6	
Political Science	10	7	17	75	13	32	+ 19	59.4
Psychology	19	13	32	80	26	64	+ 38	59.4
Social Work	5	3	8	50	4	4	—	—
Sociology	13	9	22	75	16	26	+ 10	38.5
Sub-Total Social Sciences	**103**	**70**	**173**	—	**135**	**232**	**+ 97**	**41.8**
TOTAL HUMAN SCIENCES	**253**	**170**	**423**	**80**	**312**	**562**	**250**	**44.5**

Table 25 (cont'd)

Demand and Supply of University Teachers with a Doctorate Degree, 1977–78

	New Growth	Replacement	New Total	Proportion with Doctorate	Effective Demand	Potential Supply	Surplus (+) Demand (–)	Percentage under-utilized
Agriculture	5	4	9	80	7	14	+ 7	50.0
Biology	11	7	15	50	14	26	+ 12	46.2
Botany	3	2	5	80	4	32	+ 28	87.5
Veterinary Medicine	3	2	5	80	4	11	+ 7	63.6
Zoology	6	4	10	80	8	33	+ 25	75.8
Sub-Total Biological Sciences	**28**	**19**	**47**	-	**37**	**116**	**+ 79**	**64.6**
Architecture	3	2	5	50	2	6	+ 4	66.7
Chemical Engineering	4	2	6	75	4	24	+ 20	83.3
Civil Engineering	6	4	10	75	8	25	+ 17	68.0
Electrical Engineering	6	4	10	75	8	42	+ 14	33.3
Mechanical Engineering	5	3	8	75	6	24	+ 18	75.0
Mining Engineering	2	1	3	75	2	15	+ 13	86.7
Forestry	2	2	4	75	3	6	+ 3	50.0
Other Applied Sciences	6	4	10	75	8	13	+ 5	38.5
Sub-Total Applied Sciences	**34**	**22**	**56**	—	**41**	**155**	**+ 114**	73.5
Dentistry	4	3	7	75	5	3	– 2	
Medicine	45	30	75	75	56	76	+ 20	26.3
Pharmacy	2	2	4	85	3	12	+ 9	75.0
Sub-Total Health Professions	**51**	**35**	**86**	—	**64**	**91**	**+ 27**	**29.7**
Mathematics and related	19	13	32	75	24	58	+ 34	58.6
Chemistry	17	11	28	90	25	86	+ 61	70.9
Geology and Related	8	5	13	90	12	24	+ 12	50.0
Physics	22	15	37	90	33	62	+ 29	46.8
Sub-Total Physical Sciences	**66**	**44**	**110**	—	**94**	**230**	**+ 136**	**59.1**
TOTAL NATURAL SCIENCES	**179**	**120**	**299**	**80**	**236**	**592**	**352**	**59.4**
GRAND TOTAL	**446**	**300**	**746**	—	**560**	**1,194**	**+ 602**	**50.4**

* Grand total includes demand and supply information for the "other" disciplines not identified.

Table 26

Supply and Demand of University Teachers ith a Ph.D. Degree by Teaching Field, 1977-78 to 1981-82

	1977–78			1978–79			1979–80			1980–81			1981–82		
	Supply	Demand	Surplus(+) or Deficit(–)	Supply	Demand	Surplus(+) or Deficit(–)	Supply	Demand	Surplus(+) or Deficit(–)	Supply	Demand	Surplus(+) or Deficit(–)	Supply	Demand	Surplus(+) or Deficit(–)
Humanities	278	137	+141	278	137	+141	278	137	+141	278	137	+141	278	137	+141
Social Sciences	284	175	+109	284	175	+109	234	175	+109	284	175	+109	284	175	+109
Sub-Total Human Sciences	**562**	**312**	**+250**	**562**	**312**	**+250**	**562**	**312**	**+250**	**562**	**312**	**+250**	**562**	**312**	**+250**
Applied Sciences	155	41	+114	155	41	+114	155	41	+114	155	41	+114	155	41	+114
Biological Sciences	116	37	+79	116	37	+79	116	37	+ 79	116	37	+79	116	37	+79
Health Sciences	91	64	+27	91	64	+27	91	64	+27	91	64	+27	91	64	+27
Physical Sciences	230	94	+136	230	94	+136	230	94	+136	230	94	+136	230	94	+136
Sub-Total Natural Sciences	**592**	**236**	**+356**	**592**	**236**	**+356**	**592**	**236**	**+356**	**592**	**236**	**+356**	**592**	**236**	**+356**
GRAND TOTAL	**1,194**	**548**	**+646**	**1,194**	**548**	**+646**	**1,194**	**548**	**+646**	**1,194**	**548**	**+646**	**1,194**	**548**	**+646**

Notes

[1] The views expressed by the author are his own and not necessarily those of Statistics Canada.

[2] "The Ph.D. Dilemma in Canada: A Case Study." This study also provided a selected bibliography on the subject in the Canadian context, pp. 128–131.

[3] Highlights of this information have been discussed in a separate article, "Profile of Ph.D.s in Canada," *Canadian Statistical Review,* (July, 1976).

[4] The mailing list for the Highly Qualified Manpower Survey of 1973 was derived from the 1971 Census. Consequently, no one with a Ph.D. who immigrated to Canada between June 1971 and fall of 1973 was included.

[5] This refers to intention of immigrants, not positions obtained. There is another group of immigrants whose original intended occupation was not university teaching, but who were eventually employed by universities.

[6] Since employees of a number of federal agencies such as the National Research Council, the Economic Council and crown corporations were not part of the "Data Stream" of the Commission, this figure underestimates the actual number of Ph.D.s in the public service. Moreover, some Ph.D. holders in the government sector might not have identified themselves as such.

[7] Some of these graduate programs are given in affiliation with other universities.

[8] It nees to be stressed that these figures do not indicate the actual magnitude of unemployment of Ph.D. holders. It means that doctoral graduates will have to look beyond the traditional university employment sector. It seems unlikely that Ph.D.s will be unemployed, but a certain amount of under-employment may be expected and that Ph.D. holders may displace those who are less qualified.

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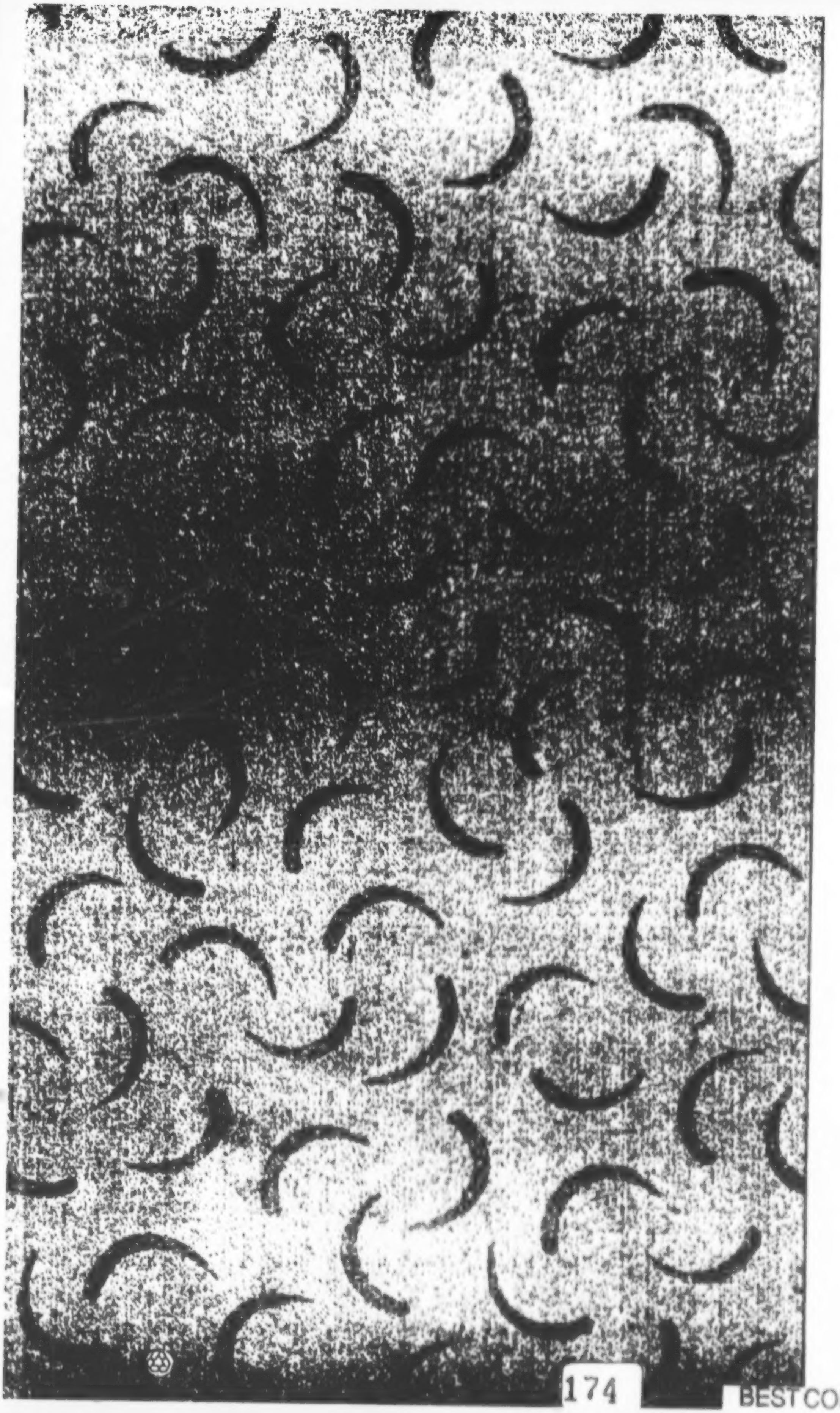

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